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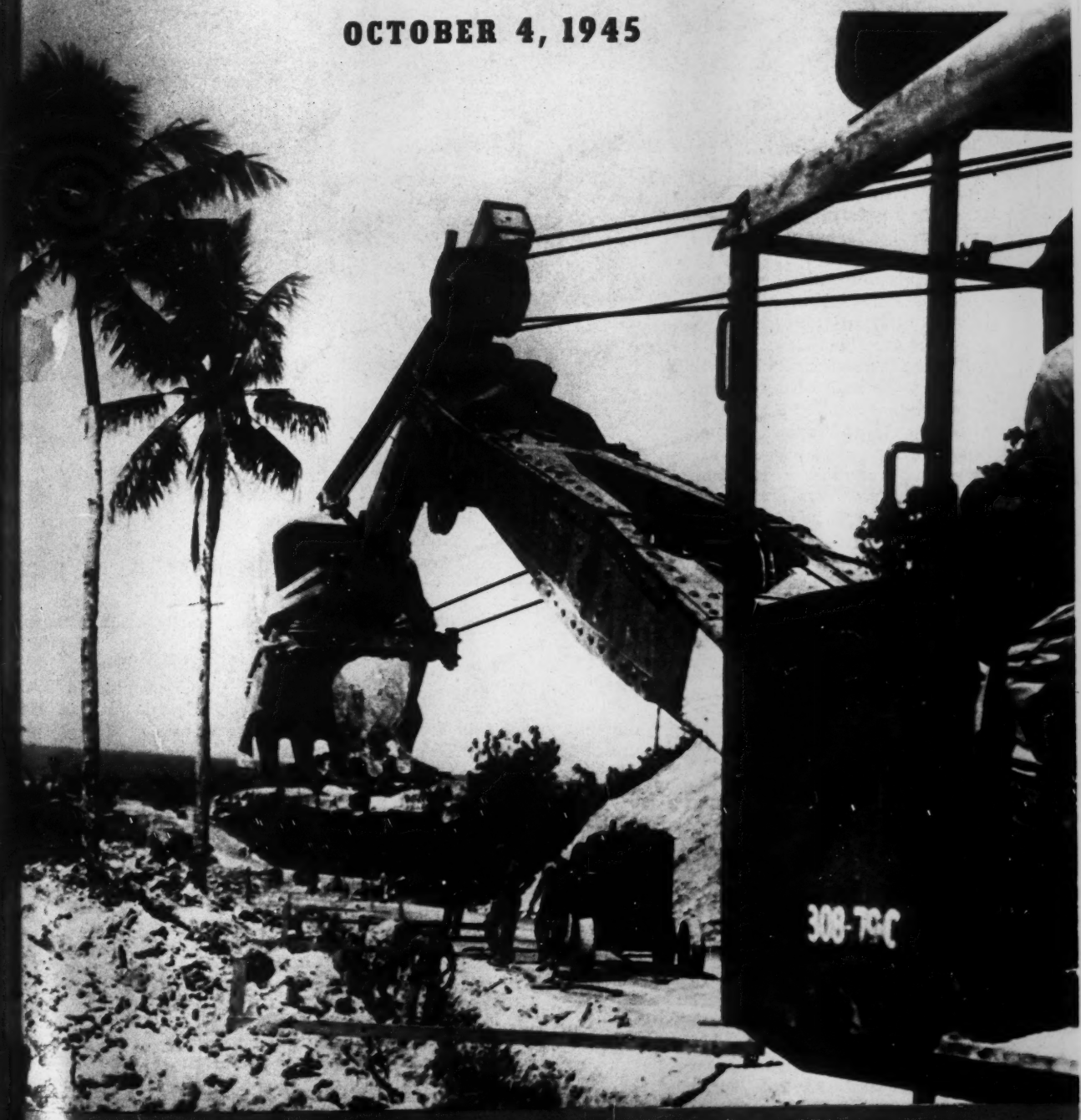
OCT 8 1945

ENGINEERING NEWS-RECORD

OCTOBER 4, 1945

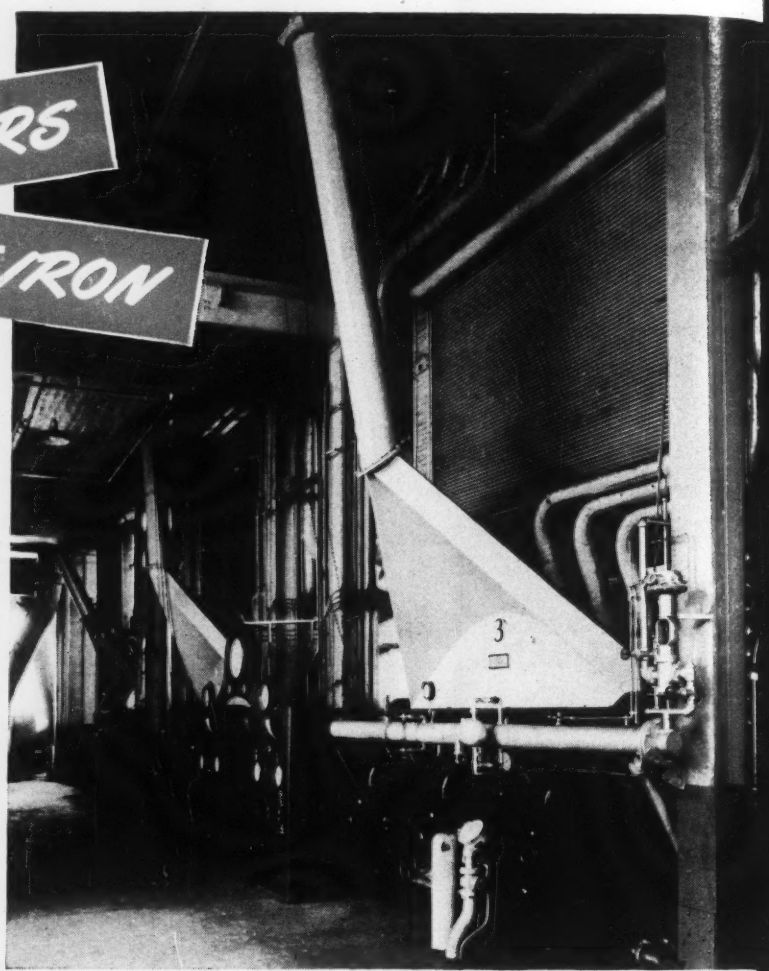


...methods and equipment expedite installation of a sewer system on Guam—See page 117

WHERE THERE'S COAL THERE'S CORROSION

so these chutes are

BYERS WROUGHT IRON



When it comes to building or repairing equipment, the engineers' job is only half done when he designs for structural strength. He must design for *wear* as well. This is of extra importance in coal handling equipment, where sulfur compounds in the fuel may be leached out by moisture, and form aggressive, destructive acids.

When the new coal chutes illustrated were built at the American Viscose Corporation Plant at Parkersburg, West Virginia, the engineers gave proper weight to the wear factor, and selected materials accordingly. Byers Wrought Iron Pipe, 16-inches in diameter, was used to convey the coal from overhead bins to the stokers. A 26-inch pipe, fabricated from Byers Wrought Iron ¼-inch plates, carries pulverized coal from railroad cars.

Conditions under which coal chutes operate and the character of the coal conveyed, vary so widely that no one can say exactly how long any individual installation will last. But the experience of users who have made comparative tests very definitely indicates that under any given situation, wrought iron can be expected to last longer, and to cost less per year of service. The extra cost of wrought iron is generally only a small percent of the total investment. After this is written off by a short period of extra life, each additional month and year on the job pays a definite dividend.

In one installation where very careful records were kept, wrought iron lasted twice as long, and handled over three times as many tons of coal, as the low-first cost material previously used.

The reason for wrought iron's unusual service is found in its unusual structure. Tiny fibers of glass-like silicate slag—250,000 or more to the square inch of section—are threaded through a main body of high-purity iron. These fibers act like baffles, in halting and dispersing corrosive attack, and so discourage pitting and rapid penetration.

Our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment" illustrates and describes a number of installations. Let us send you a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

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GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
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ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewers, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Shipbuilding, Irrigation, Canals, Railroads

McGRAW-HILL PUBLISHING COMPANY, INC.

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WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Publisher*

Vol. 135 OCTOBER 4, 1945 No. 14

COMING NEXT

• A special section on Peacetime Building, scheduled for the Oct. 18 issue, focusses attention on practices and products that have come to the fore during the war. It should prove especially valuable to those who, for one reason or another, have been unable to keep fully informed on the rapid-fire developments that took place during this period. To encourage, and in some cases to enable, engineers and architects to utilize these innovations, an article on modular design, indicating what designers are to expect as a result of its adoption will be included. Also articles on aluminum, steel, concrete and timber, discussing data now available that make new designs possible.

• Building the Port Apra breakwater to protect the harbor at Guam is one of the most interesting and difficult jobs yet undertaken by the Seabees in the Pacific. When finished, the structure will be a 2,000,000-cu.yd. rubble mound faced with rocks ranging up to 30 tons in weight. Excavation and large-scale rock-handling problems—without the use of adequate equipment—are being solved by Seabee ingenuity. See *ENR* for Oct. 18.

• A long reinforced-concrete slab-and girder bridge for the Virginia Department of Highways is being constructed of precast T-beam deck slabs weighing 110 tons. They are cast in 40-ft. sections at a central yard and floated by barge to the bridge site. Water is pumped into the scow to lower the slabs into place. Use of form lumber is reduced to a minimum, extensive falsework eliminated and concrete is being placed on a production line basis. The project will be described in the Oct. 18 issue.

LOOKING AHEAD

• In order to obtain concrete free from surface defects, engineers on the Norfolk Dam project used a fabric-covered ⅛-in. thick absorptive lining for forms at a cost of 12c. per sq. ft. When this material was backed-up with a non-absorptive lining a better surface was obtained and at a saving of 3½c. per sq. ft. over use of the material directly on wood sheathing. Methods of application and field experience with both types of lining will be outlined in an article scheduled for an early issue.

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Number of copies of this issue printed: 38,474

DO YOU WANT AN INDEX?

Due to the paper shortage, no index for volume No. 134 (Jan.-Aug., 1945) will be issued except to subscribers who ask for it. If you want a copy of the index please send in the coupon below.

Editor—Engineering News-Record
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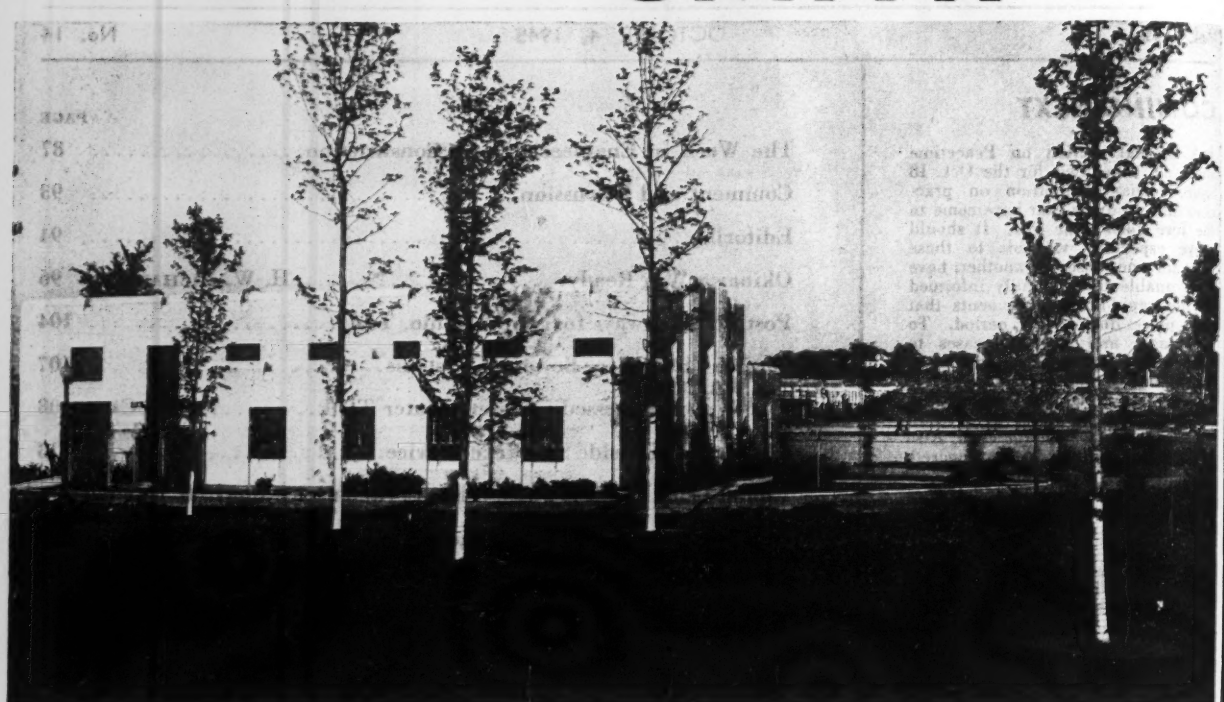
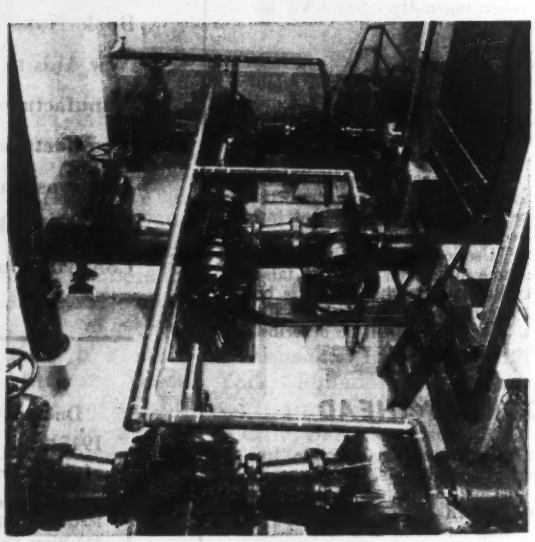
14 Rotovalves by S. MORGAN SMITH COMPANY



in the Modern *"Activated Sludge"* Plant of the City of Jackson, Michigan



CLIMAXING the trend in plant beautification the Jackson Sewage Treatment Works can be called a "Dream Plant." The grounds are arranged for use as a Park, thus showing the citizens that sewage disposal facilities need not be unattractive.

Actually, the grounds are popular and even used for picnics during the warm weather. Plant inspection by the Public is invited.

S. Morgan Smith Company is indeed proud of the fact that 14 of its Rotovalves were selected for use in this installation.

S. MORGAN SMITH CO.
YORK • PENNSYLVANIA

New Construction in September

CIVIL ENGINEERING construction volume climbed to $235,155,000 in September, an average of $58,789,000 for each of the four weeks of the month, and the highest weekly average volume reported since July 1943. Private construction reached the highest total since October 1940 and is the principal factor behind the increase in construction volume. The September weekly average volume is 37 percent higher than the average for the five weeks of August 1945, and is 99 percent above the four-week September 1944 average.

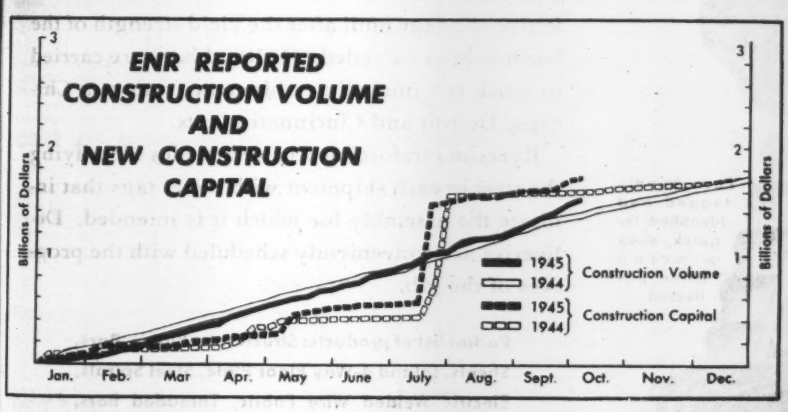
Private construction, on the weekly average basis, tops last month by 120 percent, and is up 758 percent compared with last year. Increased activity in both industrial and commercial building, is responsible for the rise in private work. Public construction, however, is 29 percent lower than a month ago and 32 percent under a year ago as a result of the decrease in federal volume. Federal construction drops 53 percent below the preceding month and 63 percent below the corresponding 1944 month's total. The decrease in federal volume offset the 10 percent gain in state and municipal construction as compared with a month ago, and the 72 percent increase as compared with a year ago.

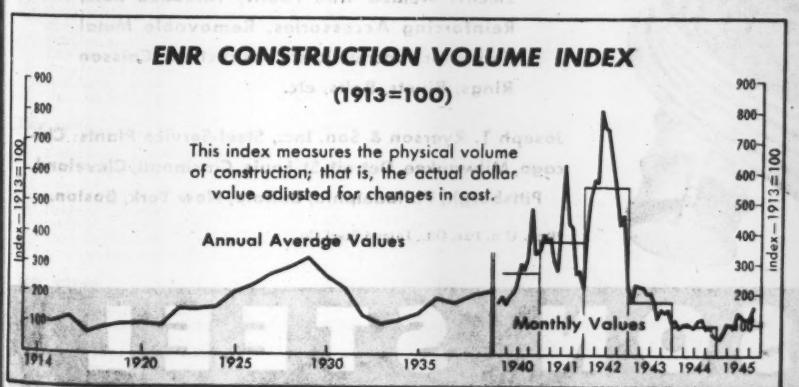
The September construction total brings 1945 volume to $1,496,254,000 for the nine-months, an 8 percent increase over the $1,379,561,000 reported for the corresponding 1944 period. Private construction, $561,764,000, is 93 percent above last year, and is responsible for the higher total as public construction, $934,490,000, is 14 percent below a year ago. Of the public total, $258,582,000 is in state and municipal work, up 35 percent compared with last year, and $675,908,000 is in federal work, 25 percent below 1944.

Industrial building volume totals $362,097,000 for the nine-month period, 170 percent above a year ago, and the top total reported for the opening nine months since 1941. In addition to the industrial building gain, increases over their respective 1944 three-quarter totals are recorded in waterworks, 65 percent; sewerage, 2 percent; bridges, 130 percent; highways, 4 percent; and commercial buildings, 13 percent.

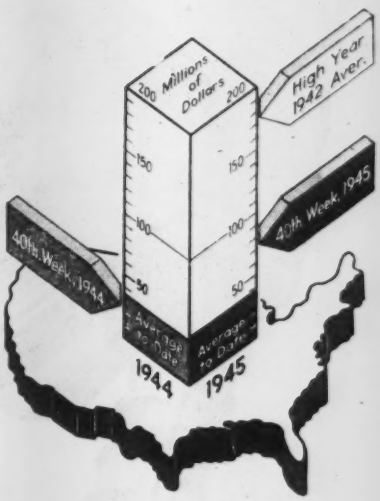
Geographically, five of the six sections of the country record gains over their 1944 nine-month totals. New England volume is up 68 percent; Middle Atlantic, 22 percent; South, 1 percent; Middle West, 55 percent; and West of Mississippi, 33 percent. Far West, with a total 27 percent lower than a year ago, is the only decrease reported.

(*See Volume Table, page* 85)




ENR CONSTRUCTION VOLUME INDEX
(1913=100)
This index measures the physical volume of construction; that is, the actual dollar value adjusted for changes in cost.
Annual Average Values
Monthly Values
Index—1913=100
1914 1920 1925 1930 1935 1940 1941 1942 1943 1944 1945

CONSTRUCTION ACTIVITY



As Reported This Week to... *Engineering News-Record*

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Oct. 4 1945	Cumulative 1945 (40 wk.)	Cumulative 1944 (40 wk.)
Federal	$4,829	$680,737	$913,524
State & Mun.	9,928	268,510	197,974
Total Public	$14,757	$949,247	$1,111,498
Total Private	59,974	621,738	294,593
U. S. Total	**$74,731**	**$1,570,985**	**$1,406,091**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Type of Work	Dollar Volume (Thousands) This Week	Cumulative 1945 (40 wk.)	Cumulative 1944 (40 wk.)
Waterworks	$316	$10,660	$25,203
Sewerage	1,156	25,369	24,829
Bridges	1,525	27,413	12,219
Highways	4,762	173,566	164,900
Earthwork, Waterways	1,803	40,104	56,772
Buildings, Public	3,153	416,701	517,407
Industrial	28,248	390,345	137,108
Commercial	26,046	155,666	114,697
Unclassified	7,722	301,221	352,956

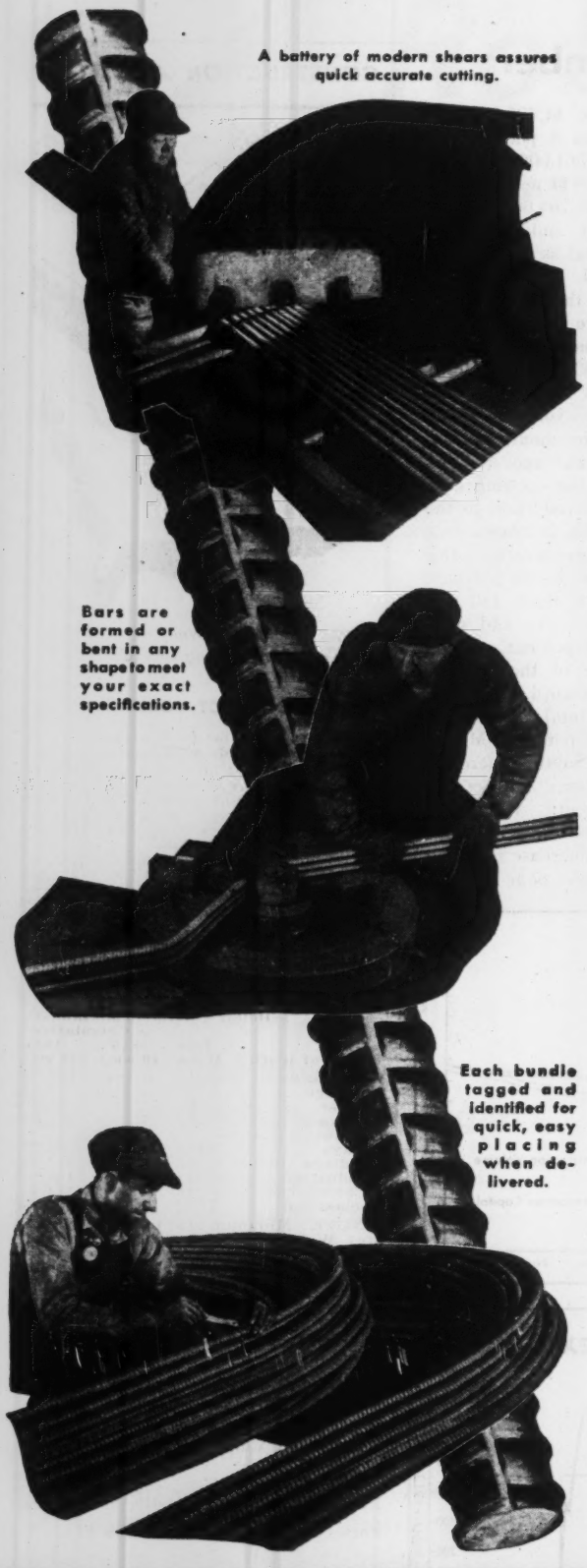
NOTE: Minimum size projects included are: Waterworks and waterway projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1945 40 wk.	Cumulative 1944 40 wk.
NON-FEDERAL	$622,361	$351,670
Corporate Securities	145,860	96,795
State and Municipal	312,901	113,935
RFC Loans	24,600	57,940
REA Loans	60,000	20,000
Fed. Aid, Highway	79,000	63,000
FEDERAL	$1,049,898	$1,263,800
Total Capital	$1,672,259	$1,615,710

ENR INDEX NUMBERS

Index Base — 100		1913	1926
Construction Cost	Oct. '45	309.28	148.67
Building Cost	Oct. '45	240.35	129.93
Volume	Sept. '45	164	72



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Each bundle tagged and identified for quick, easy placing when delivered.

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Call Ryerson

RYERSON, your dependable source for all kinds of construction steels, is well equipped for cutting, bending, forming, welding, or otherwise preparing all materials to your exact specification.

This is a complete service, you deal with competent, practical engineers who are familiar with construction problems, and who will work with you in every step from the lump sum or per pound price quotation, to final delivery. These men are always glad to help you.

Hi-Bond reinforcing bars provide the strongest known grip between steel and concrete. Pull tests with Hi-Bond imbedded in concrete, show no effective slippage until after the yield strength of the bar has been exceeded. Hi-Bond bars are carried in stock for immediate shipment from our Chicago, Detroit and Cincinnati plants.

Ryerson reinforcing service includes identifying the steel in each shipment with metal tags that indicate the assembly for which it is intended. Deliveries are conveniently scheduled with the progress of the job.

Partial list of products: Structurals, Plates, Bars, Sheets, Inland 4-Way Floor Plate, Steel Spirals, Electric Welded Wire Fabric, Threaded Bars, Reinforcing Accessories, Removable Metal Forms for concrete joist construction. Caisson Rings, Rivets, Bolts, etc.

Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

*Reg. U.S. Pat. Off., Inland Steel Co.

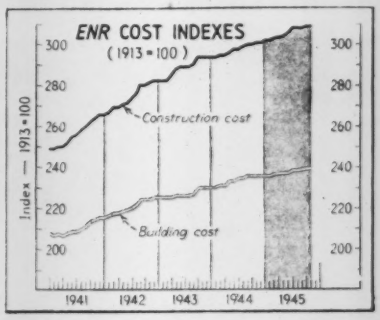
RYERSON STEEL

OCTOBER CONSTRUCTION BUSINESS REPORT

ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

(,000 omitted)	September 1944	September 1945	% Change	Nine Months 1944	Nine Months 1945	% Change
Total U. S. Construction	$117,919	$235,155	+99.0	$1,379,561	$1,496,254	+8.0
Private Construction	19,561	167,853	+758.0	291,267	561,764	+93.0
Public Construction	98,358	67,302	−32.0	1,088,294	934,490	−14.0
Federal	75,233	27,600	−63.0	897,144	675,908	−25.0
Total New Productive Capital	$14,468	$47,473	+228.0	$1,612,620	$1,649,236	+2.0
Private Investment	14,318	47,473	+232.0	207,880	435,738	+110.0
Federal (non-federal work)	150	.....	.....	140,940	163,600	+16.0
Federal (federal work)	.....	.....	.....	1,263,800	1,049,898	−17.0
E N R Construction Volume Index, 1913 = 100	85	164	+93.0	102*	108*	+6.0

* *Nine-month average.*



CONSTRUCTION COSTS . . . . WAGE RATES . . . . MATERIAL PRICES

	October 1944	October 1945	% Change	Changes September to October 1944 Sept.	1944 Oct.	1944 %	1945 Sept.	1945 Oct.	1945 %
E N R Construction Cost Index, 1913 = 100‡	301.06	309.28	+2.7	300.46	301.06	+0.1	309.28	309.28	0
E N R Building Cost Index, 1913 = 100‡	236.00	240.35	+1.8	236.00	236.00	0	240.07	240.35	+0.1

‡ *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$0.886	$0.917	+3.5	$0.883	$0.886	+0.3	$0.917	$0.917	0
Skilled labor (Av. 3 trades)	1.640	1.674	+2.1	1.640	1.640	0	1.670	1.674	+0.2
Bricklayers	1.739	1.770	+1.8	1.739	1.739	0	1.770	1.770	0
Structural Ironworkers	1.694	1.727	+1.9	1.694	1.694	0	1.720	1.727	+0.4
Carpenters	1.487	1.525	+2.6	1.487	1.487	0	1.519	1.525	+0.4
Cement, per barrel	$2.68	$2.76	+3.0	$2.67	$2.68	+0.4	$2.75	$2.76	+0.4
Reinforcing steel, cwt.	2.79	2.79	0	2.79	2.79	0	2.79	2.79	0
Structural steel, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
Sand, per ton	1.25	1.24	−0.8	1.23	1.25	+1.6	1.24	1.24	0
Lumber, 2x4 Fir, per M ft.	54.58	55.63	+1.9	54.58	54.58	0	55.63	55.63	0
Lumber, 2x4 Pine, per M ft.	53.38	53.84	+0.9	53.38	53.38	0	53.84	53.84	0
Common brick, per M	16.99	19.08	+12.3	16.52	16.99	+2.8	18.98	19.08	+0.5
Ready-mixed concrete, c.y.	7.45	7.63	+2.4	7.44	7.45	+0.1	7.62†	7.63	+0.1
Struct. clay tile, 3x12x12	81.00	85.07	+5.0	80.48	81.00	+0.6	85.07	85.07	0
Paving asphalt, cars, ton	15.40	15.48	+0.5	15.40	15.40	0	15.48	15.48	0

† *Revised.*

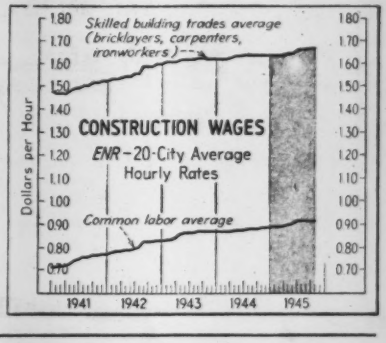
ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Oct., 1945	309.28	148.67	240.35	129.93	.....	.....
Sept., 1945	309.28	148.67	240.07	129.77	164	72
Aug., 1945	309.08	148.57	239.94	129.70	119	52
July, 1945	308.99	148.53	239.64	129.54	119	52
June, 1945	308.99	148.53	239.37	129.40	133	58
May, 1945	307.43	147.78	238.46	128.90	93	41
April, 1945	306.43	147.30	238.46	128.90	99	43
Mar., 1945	304.50	146.37	237.85	128.57	103	45
Feb., 1945	303.70	145.99	237.71	128.50	78	34
Jan., 1945	302.50	145.41	236.51	127.85	63	28
Dec., 1944	302.30	145.32	236.51	127.85	66	29
Nov., 1944	301.09	144.73	236.10	127.63	74	33
Oct., 1944	301.06	144.72	236.00	127.57	91	40
Sept., 1944	300.46	144.43	236.00	127.57	85	37
1944 (Av.)	298.64	143.59	234.73	126.89	96	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77
1942 (Av.)	276.31	132.82	222.39	120.22	553	243
1941 (Av.)	257.84	123.95	211.46	114.32	375	164

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	September 1944	September 1945	% Change	Aug. 1945	% Change Aug.-Sept.
Steel (% operating capacity) A. I. S. I.	95.1	80.5	−15.4	78.7	+2.3

	August 1944	August 1945	% Change	Eight Months 1944	Eight Months 1945	% Change
Fabricated Structural Steel, tons, A.I.S.C.	55,205	53,207	−3.6	358,131	458,238	+28.0
Cement, thous. bbl. U. S. B. of M.	10,758	11,467	+6.6	61,875	65,442	+5.9
Building Permits, 215 cities, Dun & Bradstreet (,000 omitted)	$123,320	$113,540	−8.0	$503,728	$607,296	+20.5



COST OF LIVING INDEX . . . . . CIVIL NON-AGRICULTURAL EMPLOYMENT

	August 1944	August 1945	% Change	July 1945	% Change July-Aug.
Cost of Living Index, N. I. C. B.	105.0	106.6	+1.5	106.9	−0.3
Rent (Housing) Index, N. I. C. B.	90.9	91.0	+0.1	91.0	0
Total Employment (est.) thous., B. L. S.	38,744	36,844	−4.8	37,205	−0.8
Constr. Employment (est.) thous., B. L. S.	700	933	+33.3	896	+4.1

ENGINEERING CONSTRUCTION CONTRACTS — ENGINEERING NEWS-RECORD — SEPTEMBER, 1945

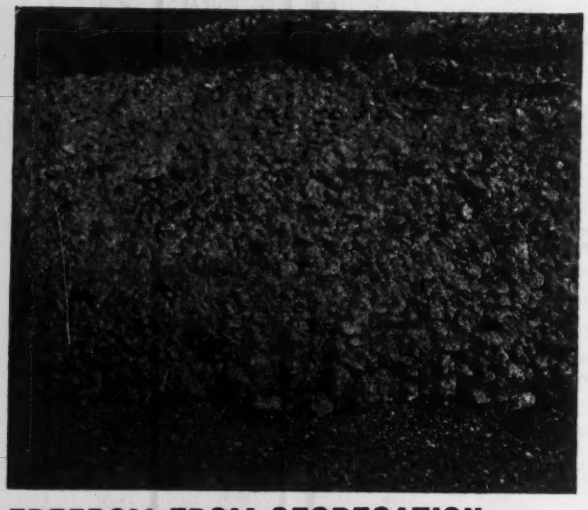
Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—waterworks, excavation, drainage and irrigation,* $15,000 *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Four Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States September 1945	United States Nine Months 1945	United States Nine Months 1944	Canada
Public Works										
Waterworks	.....	869	1,187	607	317	1,948	4,928	40,344	24,429	772
Sewerage	186	147	108	888	300	1,144	2,773	24,213	23,852	414
Bridges, public	105	740	298	827	1,274	257	3,501	22,082	9,888	105
Earthwork and waterways	145	438	737	1,566	1,288	1,111	5,285	38,301	53,651	87
Streets and roads	845	4,275	4,087	6,387	4,059	2,014	21,667	168,804	162,838	3,675
Buildings, public	554	2,819	1,593	3,395	2,530	2,735	13,626	413,548	510,925	7,312
Unclassified, public	430	5,820	1,444	2,350	3,710	1,768	15,522	227,198	302,711	275
Total public	**2,265**	**15,108**	**9,454**	**16,020**	**13,478**	**10,977**	**67,302**	**934,490**	**1,088,294**	**12,640**
Federal government (included in above classifications)	**764**	**8,229**	**2,767**	**4,601**	**4,245**	**6,994**	**27,600**	**675,908**	**897,144**	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	3,806	1,357	.....
Industrial buildings	3,140	23,936	8,173	49,482	6,856	6,824	98,411	362,097	134,461	4,934
Commercial buildings	1,350	30,323	318	4,003	4,668	10,893	51,555	129,560	114,369	150
Unclassified, private	46	1,830	4,280	543	10,523	665	17,887	66,301	41,080	502
Total private	**4,536**	**56,089**	**12,771**	**54,028**	**22,047**	**18,382**	**167,853**	**561,764**	**291,267**	**5,586**
Total Engineering Construction:										
September 1945 — 4 weeks	**6,801**	**71,197**	**22,225**	**70,048**	**35,525**	**29,359**	**235,135**	.....	.....	**18,226**
August 1945 — 5 weeks	11,188	36,976	29,733	35,816	49,208	51,039	213,960	.....	.....	19,658
September 1944 — 4 weeks	5,298	13,481	23,388	16,345	25,717	33,690	117,919	.....	.....	8,423
Nine months — 1945	**65,501**	**253,635**	**236,871**	**268,056**	**314,501**	**357,690**	.....	**1,496,254**	.....	**117,022**
Nine months — 1944	38,951	207,684	235,191	172,744	237,683	487,308	.....	.....	**1,379,561**	79,978

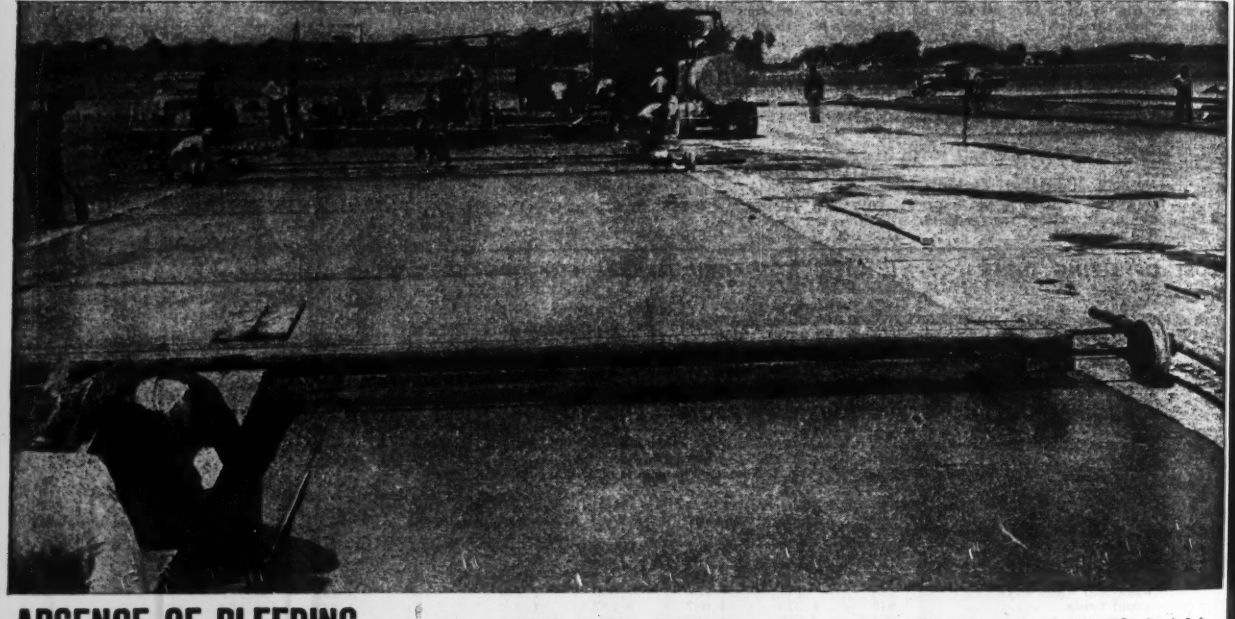
Paving at an Army Airport...

**PICTURES ILLUSTRATE THREE ADVANTAGES OF ATLAS DURAPLASTIC*
THE AIR-ENTRAINING CEMENT ORIGINATED AND DEVELOPED BY UNIVERSAL ATLAS**



FREEDOM FROM SEGREGATION of concrete made with Duraplastic cement shown by steep rounded edges of concrete after dumping.

PLASTICITY: Concrete after first and only pass of finishing machine indicates plasticity imparted by Duraplastic cement.



ABSENCE OF BLEEDING or "water-gain" of Duraplastic concrete permits completing all finishing operations closer to paver. This is especially important when concreting is stopped at end of a day's run.

ATLAS DURAPLASTIC

TRADE MARK REG. U. A. C. CO.

AIR-ENTRAINING PORTLAND CEMENT

Product of Universal Atlas Cement Company

(United States Steel Corporation Subsidiary)

ENR-9-34

SUNDAY EVENINGS—American Broadcasting Company (Blue) Network—U. S. Steel's "The Theatre Guild on the Air"

The Week In Engineering and Construction

ENGINEERING NEWS-RECORD • OCTOBER 4, 1945 • VOLUME 135 • NUMBER 14

FWA to carry out local planning survey

The Federal Works Agency, at the request of the House Special Committee on Postwar Economic Policy and Planning and the Senate Small Business Committee, is soon to initiate a new survey on the volume and status of state and local public works planning. In reporting on its findings, the FWA will confine its conclusions to plans in the completed stage and plans that are in the design stage. The FWA plans a continuing report so that up-to-date information on planning will be available at all times. Its first survey of postwar planning was made about a year ago. (*ENR* Sept. 21, 1944, vol. p. 331).

Applications to FWA for advances for planning as of Sept. 15 totalled over $18,000,000. The aid was requested for projects estimated to cost nearly $600,000,000. Actual advances up to that time totalled $4,839,000.

The money is being supplied from a $17,500,000 item included in the Independent Offices Appropriation Act approved May 3, 1945. This sum is thought to be so small that the FWA considers an additional appropriation in the neighborhood of $100,000,000 necessary if local planning is to be assisted to the desired extent.

• • •

Hold back state work to avoid competition

Seeking to avoid competition with private construction, the State of Michigan has announced that its proposed $80,000,000 institutional building program will be delayed. Governor Harry Kelly announced that only emergency projects such as elimination of fire hazards will be ordered built in the near future.

The decision was made after a meeting in which construction industry representatives told the governor that the construction industry will be unable to expand rapidly enough to handle all of the public, industrial and private projects now being considered.

A "serious shortage" of skilled labor was cited as one obstacle to very extensive construction work in the immediate future.

Commerce Department sets up unit to report on construction industry

Appoints former WPB construction chief to head new division—Will collect data for comprehensive industry picture

John L. Haynes, until recently director of the construction bureau of the War Production Board, has been made head of the newly established construction division in the Department of Commerce. He has been chosen because of "his varied experience in the industry and the record he established with the WPB," according to Amos E. Taylor, director of the Bureau of Foreign and Domestic Commerce.

Creation of the new construction division became possible when $75,000 earmarked for this purpose was included in the Deficiency Bill passed in July (*ENR* July 12, vol. p. 20).

In setting up the new division, Haynes has three major objectives. These are: As rapid an expansion of the construction industry as possible, a higher yearly volume of construction in the postwar period than before the war, and a more even annual volume of construction. It is also hoped that building costs can be reduced.

J. L. Haynes

The federal government is desirous that the industry will have a total yearly volume of $15 to $20 billion. To be of greatest assistance in obtaining this total, the primary task of the new division will be to organize and synthesize information obtained from a variety of both government and private agencies, and fashion these data into a comprehensive picture of the construction industry as a whole.

To accomplish this work the Department of Commerce requested $350,000, but this amount was reduced to $150,000 by the Bureau of the Budget, and finally to $75,000 by Congress. Soon Congress will be asked to supply more money, it is understood, to permit the bureau to function properly.

It is to be noted that this will be the first federal agency seeking to follow the overall progress of construction as intensively as the Commerce Department now plans. During recent years much assistance to the industry has been supplied by the Bureau of Labor Statistics, the Federal Housing Agency, the Bureau of Standards, the Federal Works Agency and the WPB. But in no agency in the past has there been a division combining all the data the Department now seeks to unite.

Haynes is a civil engineer

After obtaining both civil engineering and law degrees at George Washington University, Haynes was employed by the Charles H. Tompkins Co., Washington, D. C. He was next associated with the U. S. Army Engineers and later with the N. P. Severn Co., Chicago. Subsequently, he was resident engineer on public building construction in the Washington, D. C., area.

When he joined the WPB in December, 1941, Haynes was made chief of the Lumber and Building Materials Branch, and in April, 1942, was named director of the Building Materials Division. He was designated director of the Construction Bureau in December of 1944.

In a reorganization of the WPB to fill the vacancy created by the shift of Haynes and to speed up reconversion, Joseph D. Keenan, vice-chairman for labor production since 1943, has been designated to coordinate all construction activities of the WPB. Keenan recently returned from Germany where he had been deputy director of the manpower division of the U. S. Group Control Council for Germany. He has long been associated with the labor problems of the industry. Before entering government service in July, 1940, he was secretary of the Chicago Federation of Labor and was active in the Building Trades Council of Chicago and the International Brotherhood of Electrical Workers.

Highway work plans continue to mount

State highway departments, last week continued to add to the mounting total of construction work for the coming year, under the federal-aid matching plan (*ENR*, Sept. 13, vol. p. 335).

Among the programs made public were:

Charles M. Ziegler, Michigan state highway commissioner, said state, county and city road building programs for the first postwar year would give the state a total highway program of about $39,000,000.

Louisiana's Governor James H. Davis announced that a "large part" of about $140,000,000 available in federal, state and parish money would be spent on a superhighway network and other road work.

The Pennsylvania State Department of Highways said it had started new construction and road repairs for the current year totaling $19,000,000, including 18 new construction projects for a value of $3,000,000, 73 contracts aggregating 198 miles for resurfacing and widening of existing roads for a cost of $6,000,000, and resurfacing by department forces of an additional 372 miles of road at $2,650,000.

In Ohio, which is preparing to spend $50,000,000 a year above its normal highway work state highway director Perry T. Ford urged the state political subdivisions to start planning postwar work at once to permit the department to coordinate these plans to a superhighway system.

Connecticut expected to receive $5,000,000 in federal funds for road construction, and sought means of raising necessary funds to match the grant. Highway commissioner William J. Cox requested the state attorney general for an opinion as to whether the state highway department may borrow funds necessary for the work from construction funds allocated for other purposes. He named specifically money set aside as town aid funds, unimproved town road money and state aid funds that were described as diminishing currently. The state would like to borrow amounts from these funds not committed to specific contracts.

South Carolina announced approval of a $42,000,000 postwar road program; Virginia tentatively allocated $12,298,000 for primary road construction; Illinois planned to spend $8,000,000 for arterial highways, $4,000,000 for secondary roads and nearly $10,000,000 for city thoroughfares; Maryland approved a $7,000,000 highway and bridge project plan.

In Kansas, D. J. Fair, state highway director, said that more than $26,000,000 in highway construction contracts will be awarded before the end of the year. The New York division of highways, department of public works said that it will reconstruct 60 miles of highways near Rochester, at a cost of about $4,000,000.

B. D. Tallamy, deputy state superintendent of public works for New York, said in an address at Sidney, N. Y., that the state's long-range public works plans include expenditure of $368,000,000 for arterial highway connections in cities and villages, and $202,000,000 for parkway development.

The New Mexico State Highway Commission has tentatively scheduled for construction during the remainder of 1945 $2,000,000 worth of road construction. The program is contingent upon Congressional approval of federal aid for roads, of which New Mexico expects to receive $1,200,000.

Congress approves road fund release

A resolution (HCR 81) declaring the war emergency sufficiently relieved to permit release of the federal aid road funds provided in the Federal Aid Highway Act of 1944 has been approved by both houses of Congress. The House measure was reported out to the Senate by that body's Post Office and Post Roads Committee October 2, and approved by the Senate later that afternoon.

The bill authorizes the federal government to grant the states $500,000,000 yearly for each of the first three postwar years. Of this sum, $225,000,000 is ear-marked for the federal-aid system, $150,000,000 for secondary roads, and $125,000,000 for routes through cities. A breakdown of the first year's aid for each state was given in *Engineering News-Record* Jan. 18, vol. p. 88.

Billion in road work ready for contract

At an executive committee meeting of the American Road Builders Association in Chicago Sept 27, Charles M. Upham, engineer director, submitted estimates based on Federal Works Agency surveys indicating that 1946 highway expenditures, including rehabilitation work, will be $750,000,000, or a $425,000,000 increase over the output this year. By 1949, he forecast, expenditures would reach $2,000,000,000 annually and continue at that level for several years.

"However, according to recent information from the Public Roads Administration," Mr. Upham added, "the state highway departments have projects ready for contract amounting to $616,000,000 and plans under way for $2,500,000,000 more. Estimates received by counties give a total program ready for contract amounting to $250,000,000. Municipalities should have projects ready totaling well over $150,000,000. This gives a total ready for contract of much more than $1,000,000,000 for all agencies."

Carolina flood damage set at $2,000,000

The state of North Carolina last week totalled damages of what engineers termed "the worst flood in the state's history," and found that the sum would run to about $2,000,000.

Flood waters of four rivers, including the Yadkin and Roanoke, had receded by last week. The streams had gone over their banks, destroying roads, bridges and farm land.

A. H. Graham, chairman of the State Highway and Public Works Commission said that immediate figures on damage to roads did not include actual damages which may show up later in roadbeds weakened by the flood. Bridge damage is expected to be heavy on account of washouts, and many roads are said to be injured by top soil and gravel which washed onto paved surfaces.

Torrential rains in the preceding two weeks caused the flood.

Large new asphalt plant to be built in Oregon

Asphalt, manufactured primarily to supply paving needs in Oregon, Washington and Idaho, soon will be coming from a million dollar refinery located in Willbridge, Ore., according to plans of the Standard Oil Co. of California.

Construction is expected to start on the new plant next month, H. B. Fairchild, president of the California Asphalt Corp., reported. California Asphalt is a wholly-owned subsidiary of Standard, recently formed to operate the new project.

A complete operating unit in itself, the refinery will manufacture asphalt from crude oil shipped in tankers from California oil fields. Capacity of the installation, located six miles northwest of Portland, will be between 4,000 and 5,000 bbl. a day. Finished product will be shipped from the refinery to contractors in Pacific Northwest states.

Engineers issue plan to minimize military potential of Reich industry

Engineers Joint Council finds that control of certain key industries will make it impossible for Germany to prepare for war

A plan for the control of German industries to keep them from being used for military purposes has just been issued by the Engineers Joint Council. It is the outcome of a joint statement made about a year ago (*ENR*, Oct. 5, 1944, vol. p. 395) by the presidents of the nation's five major engineering societies opposing the proposal of Henry Morgenthau, Jr., Secretary of the Treasury, for "destruction or virtual dissolution" of Germany's industrial plants in order to keep that country from making war in the future.

Last year, in reply to Secretary Morgenthau's proposal, the five presidents said, "Germany must have its chance for recovery along peaceful lines after the war. Such recovery cannot come about through an economy wholly agricultural, even if that were practicable; or without industries to produce both for German needs and for the reconstruction of other nations of Europe; or without markets.

"This, we are confident, can be done without giving German industry the independence it would require to prepare for war again, either secretly or openly. We recommend, not an indiscriminate destruction, but a selective restriction and control of German industries."

That statement was made by the presidents of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers and the American Institute of Chemical Engineers, speaking as individuals. However, it was so well received by the War Department and the State Department that the governing boards of the engineering societies determined to follow up the statement with more specific proposals.

To that end, the matter was referred to the Joint Conference Committee, now known as the Engineers Joint Council, which is composed of the president, junior past president and secretary of each of the five societies. Malcolm Pirnie, past president of the American Society of Civil Engineers, is chairman of the executive committee.

In February of this year the Joint Conference Committee set up the National Engineers Committee to make a report on how to control German industry to eliminate its capacity to provide the essentials for war. That committee was made up of Robert E. McConnell, consulting engineer, New York, chairman; Harry S. Rogers, president, Brooklyn Polytechnic Institute; Thomas F. Barton, commercial vice president, General Electric Co., New York; Carlton S. Proctor, consulting engineer, New York; Edward R. Weidlein, director, Mellon Institute of Industrial Research, and Clyde E. Williams of Battelle Memorial Inst., Columbus, Ohio.

Recommended control procedure

The committee recommends that the Control Council in Germany institute and maintain effective control of power production and distribution and industrial plant construction to (1) prohibit the synthetic fixation of nitrogen; (2) prohibit the production of synthetic liquid fuel; (3) prohibit the production of aluminum; (4) prohibit the use of atomic energy; (5) limit the capacity and production of steel and steel-product plants. This, it states, will establish a considerable measure of assurance against the danger of German rearmament, but is not intended as a substitute for the protection afforded by an adequate police force.

The committee states further that these prohibitions and controls will only result in a 5 percent reduction in the peacetime labor force, hence no serious problem in the reemployment of the displaced labor will result.

The committee points out that strict allocation of German coal and its uses would provide an effective control of all German industries, but that such control would be involved and conflicting. Similarly, industries could be controlled by a system of energy allocation, but the committee states that such control should not be used because more direct and effective means are available. The committee would have the nitrogen requirements of German agriculture supplied by other countries.

The committee also would eliminate all plants for the synthetic production of oil, first because such plants can be used for nitrogen fixation, and second as a means for controlling Germany's supply of motor fuels.

German metallic aluminum production was uneconomical and has no competitive value in world markets the committee states. It recommends, therefore, that all plants for the production of aluminum be eliminated. Fabrication of light aluminum products would be permitted but strictly controlled.

Control over construction

In order to avoid evasion of regulations against the production of potential war materials, it is recommended that rigid control of all new construction should be maintained through the issuance of permits by a board of construction control composed of experts in all potentials of war production. This would preclude the possibility of construction of plants for the development of atomic energy.

The committee also recommends that all research activities should be reduced to as small units as can effectively perform the work assigned to them by each industry. Where coordination is necessary, it should be done only under United Nations supervision.

Timber experts check German industry

Eight staff members of the U. S. Forest Products Laboratory, Madison, Wis., have been in Germany since June investigating industrial and technical secrets of that country's forest products industries, according to George M. Hunt, acting director. The mission is headed by Carlile P. Winslow, director of the laboratory. Headquarters of the committee is in London.

Particular subjects of the investigation are new methods of lignin utilization, wood treatment, timber construction, seasoning and preservation of wood, and new byproducts of wood developed by Germany during the war. About 200 Nazi-controlled plants, research institutions and leaders of German science are the objectives of the investigators.

Other staff members include R. M. Seborg, J. N. McGovern, H. O. Fleischer and J. F. Saeman, chemists; Joseph A. Liska, engineer; Fred F. Wangaard, technologist and D. G. Coleman. Also in Germany working with the laboratory investigators are G. K. Dickerman, technical director of the Consolidated Water Power and Paper Co., Wisconsin Rapids, Wis.; Fred W. Gottschalk, director of research of the American Lumber and Treating Co., Chicago; E. G. Locke, chemical engineer of the Pacific Northwest Forest Experiment Station, Forest Service, Portland, Ore.; and J. H. Tigelaar, director of research, Haskelite Manufacturing Corp., Grand Rapids, Mich.

ENGINEERING SCHOOL NEWS

RPI to give complete engineering courses in evening sessions—Means of stabilizing highway subsoil being studied at Idaho

Rensselaer Polytechnic Institute at Troy, N. Y., will make available at night the same educational training as in the day sessions. On Nov. 1, the institute will open a program of coordinated evening courses leading to baccalaureate and graduate degrees as well as individual courses covering engineering, science, management, English, literature, history and economics.

"This broad extension of our facilities," the announcement said, "will help to replenish the supply of scientific and technological personnel which has been critically diminished during the war years."

Classes will meet from one to three evenings a week, with an average of three evenings for courses leading to degrees. Credits will be given for independent courses in English, literature, history, and economics.

The evening courses will offer an opportunity to veterans entitled to educational benefits under the G. I. Bill but who find the financial allowances under it insufficient to permit them to go to college without working at the same time.

Means of stabilizing subsoil under highways to make them last longer are being studied in the University of Idaho alumni research program, according to Dr. L. C. Cady, acting dean of the college of engineering and chairman of the university research council.

In certain types of soil, moisture is drawn through capillaries in the soil as traffic passes over the road, and surface coating soon breaks through, Dr. Cady said in explaining the project. New materials have been developed which tend to stabilize the soil, making a solid foundation for the highway.

The first step will be laboratory tests of Idaho soil types to determine the stabilizing agent or mixture of agents producing best results. Next spring, in cooperation with the state highway department, a field test using the agents giving best laboratory performance will be made on the highway between Moscow and Genesee, Ida. Professor G. A. Riedesel, acting head of the department of civil engineering, is in charge of the project, with the state highway department and several manufacturers of soil stabilizing products cooperating.

The board of trustees of the University of Illinois has accepted the $21,200 John Brunner memorial fund for the college of engineering. It was bequeathed by Mrs. Cora M. Brunner, Evanston, Ill., and is to be used for research and advancement in engineering education as a memorial to her husband, John Brunner, who was a civil engineering graduate of the Royal Institute of Technology, Stockholm, and afterwards a bridge engineer for the Boston and Maine Railroad Co.

C. D. Williams, structural engineer, has been appointed acting head of the civil engineering department of the college of engineering at the University of Florida, Gainesville. Professor Williams is replacing Professor P. L. Reed, who will retire soon.

Water pollution control sought in House bill

A bill to provide for water pollution control activities in the United States Public Health Service has been introduced in Congress. The bill (H. R. 4070) grants state health authorities and agencies the authority to conduct investigations and make surveys of water pollution problems; authorizes the Federal Security Administrator to extend federal aid to states and municipalities for the construction of necessary sewage treatment works and preparation of engineering reports; and establishes a Water Pollution Control Advisory Board consisting of eight persons, the chairman of which shall be the Surgeon General.

The bill would authorize $100,000,000 to be appropriated annually for any fiscal year for construction projects, and $1,500,000 to be appropriated for each fiscal year, beginning with the fiscal year ending June 30, 1946, for investigations and surveys. The provisions of this bill are identical with those of H. R. 592, which has been revised to conform with Public Law 410 reorganizing the Public Health Service.

A $1,000,000 construction program to improve and expand the Portland, Ore., city water system will be launched immediately, Commissioner Dorothy McCullough Lee, head of Portland's public utilities department, has announced.

Bids will be called Oct. 10 for a 36-in. steel pipeline to run from Mount Tabor reservoir to two Washington Park reservoirs. Actual construction is expected to start Nov. 15.

Calendar of Meetings

NATIONAL

Associated General Contractors of America, Inc., fall meeting, Drake Hotel, Chicago, Ill., Oct. 30–31.

American Institute of Steel Construction, Annual Meeting, French Lick Springs Hotel, French Lick, Indiana, Oct. 29 to Nov. 1.

American Public Works Assn., Fifty-first annual congress, Sherman Hotel, Chicago, Ill., Nov. 4, 5 and 6.

Society for Experimental Stress Analysis, annual meeting, Hotel Astor, New York, N. Y., Nov. 26–28.

REGIONAL

Texas Water Conservation Association, yearly meeting, Austin, Tex., Oct. 3-4.

Illinois Municipal League, annual convention, Leland Hotel, Springfield, Ill., Oct. 23–25.

Engineers' Society of Western Pennsylvania, 6th annual water conference, William Penn Hotel, Pittsburgh, Pa., Oct. 22-23, in conjunction with the Civil Section.

North Dakota Water and Sewage Works Conference, Annual conference, Gardner Hotel, Fargo, Nov. 8 and 9.

Ohio Conference on Sewage Treatment, Fort Hayes Hotel, Columbus, Oct. 31 and Nov. 1.

Illinois Sewage Treatment Plant Operators, annual convention, Leland Hotel, Springfield, Nov. 8-9.

American Water Works Assn.:

(Tentative) **Four States Section,** Philadelphia Area meeting at inn near Norristown, Pa., Oct. 5.
Illinois Section, La Salle Hotel, Chicago, Ill., Oct. 30-31.
Southwest Section, Washington-Youree Hotel, Shreveport, La., Oct. 16-17.
California Section, Biltmore Hotel, Los Angeles, Calif., Oct. 23.
Ohio Section, regional meeting of North West Section, Y.M.C.A., Findlay, Ohio, Oct. 23.
Missouri Valley Section, 30th annual meeting, Hotel President, Kansas City, Mo., Oct. 29-30.
North Carolina Section, Hotel Charlotte, Charlotte, N. C., Nov. 5-7.
Virginia Section, Hotel Roanoke, Roanoke, Va., Nov. 8-9.
New Jersey Section, Hotel Madison, Atlantic City, N. J., Nov. 8-10.
Wisconsin Section, Pfister Hotel, Milwaukee, Wis., Nov. 13-15.
Florida Section, MacFadden Deauville Hotel, Miami Beach, Fla., Nov. 15-17.

Pennsylvania offers state aid for sewage and industrial waste plants

Fund of $4¼ million to assist planning of municipal plants and building of experimental treatment works for industrial wastes

Pennsylvania is prepared to make outright grants of 50 percent of the cost of plans for sewage and industrial waste treatment plants, the money to be allocated by the Department of Health to municipal authorities and private corporations. In addition, financial aid will be given to industries not to exceed half the cost of construction of experimental works as an incentive in the development of waste-treatment methods for which no satisfactory method now exists.

This announcement, made by the Department of Health, of which H. E. Moses is chief engineer, implements legislation (Act 82-A) approved on June 4 of this year. Mr. Moses reports that an appropriation totalling $4,250,000 is available to aid municipalities and industries in preparing plans for the installation of treatment facilities.

How grants are made

The Department of Health, after approval by the state Sanitary Water Board, will make a grant to a municipality of one-half of the actual cost of preparing plans, specifications, report and estimate of cost for sewage treatment works, and such intercepting sewers and pumping stations as the board deems to be an integral part of treatment facilities, provided this does not exceed the indicated percentage of the estimated cost of construction of the works as approved by the board.

The estimated construction cost, which must be based on the 1942 price level, shall not include administrative, legal or engineering fees, cost of land or preparatory engineering work, which the board considers should be performed at the municipality's own expense; nor will it include the cost of plans and reports prepared prior to April 1, 1944, which are usable in the preparation of the required plans.

No grants are available for the construction of municipal works.

Aid for industries

State aid to private persons and corporations for plans for industrial waste-treatment works will be granted only for works to treat waste for which treatment processes are not yet known or where public interest would warrant further experiments to develop more satisfactory treatment works.

Grants for the construction of waste treatment works also will be available, but only for the construction of experimental works to develop ways for treating wastes for which satisfactory methods are not yet known.

Engineering fees scheduled

The 50 percent grant is computed on the basis of one-half the sum of the fees for preliminary plans and report and the detailed plans and specifications. No fee for supervision of construction may be included.

These fees are in conformity with the scheduled fees for consulting service recommended by the Pennsylvania Society of Professional Engineers. It is believed that the statement relating to engineering fees represents the first instance where such a proposal has been set forth in connection with state grants-in-aid.

Columbus, Ohio—Judge John R. King of Franklin County Common Pleas Court, recently granted a temporary restraining order preventing Columbus from cutting off sewerage service to two of its suburbs (*ENR*, Sept. 27, vol. p. 402).

Long-term agreements sought with N. Y. workers

The General Contractors Association and the New York Building Trades Employers Association are working with the local American Federation of Labor unions to establish stabilized conditions in the metropolitan area construction industry. In return for employer support in obtaining WLB and Office of Economic Stabilization approval of an immediate wage increase to 15 percent above the pay rate of 1941, the unions are said to be willing to agree not to reopen wage questions for two years or ask changes in working conditions for five years.

Efforts are being made in the building trades to agree on a standard work day, which now varies from six to eight hours for crafts working side by side, and results in considerable confusion. Under the sought-for agreement workers would be paid on six holidays and, in the construction trades, would get one week vacation with pay if working for one employer for the full year.

Another condition of the agreement would be elimination of work stoppages and jurisdictional disputes. Agreements are being negotiated to have a labor and employer representative from heavy construction industry, a labor and employer representative from the building industry and an impartial arbiter to determine jurisdictional matters.

States move to aid airport expansion

Two states last week took positive action to speed development of airport facilities for an expected rapid expansion of commercial airline service and private aircraft use.

Minnesota allotted about $850,000 to 25 municipalities to aid in development of a statewide system of airports.

The allotments, with the advice and consent of a legislative advisory committee, are made from a $2,000,000 fund set up by the 1945 legislature. Under the act, the state is committed to spend about half of the $2,000,000 fund this year, and the state Aeronautics Commissioner has been authorized to take direct steps to approve work on small airports where runways are considered unsafe. Under this arrangement the commissioner is authorized to work directly with the municipality on a matching basis, without further authorization from the governor, to place runways in a safe, usable condition, provided the cost is not more than $5,000.

The largest grant, for $88,000, was made to Duluth.

In Illinois, the state supreme court upheld a 1945 municipal airport authority act designed to help more than 125 cities in building landing fields.

The high court, which twice had nullified a somewhat similar enabling law enacted in 1943, held that the previous objection had been met in the 1945 legislation.

The law provides that a single municipality or group of municipalities can create an airport authority which could levy taxes or issue bonds to defray cost of airport expansion work. Such authorities would be composed of five or more city commissioners, named by the mayor and county judge, after the governmental body had been approved by a referendum of voters in the airport authority's jurisdictional area. An authority can tax up to 15 cents per $100 valuation, issue bonds up to one percent of assessed property value within an airport area, and condemn property.

Promptly following the court action, two cities, Rockford and Moline, announced plans for immediate establishment of such authorities to expand local facilities.

WASHINGTON HIGHLIGHTS

Inter-American road hearings postponed—Congressional bills approve U. S.-N. Y. agreement on St. Lawrence Waterway

Although the Senate Special War Investigating (Mead) Committee announced recently that hearings on the U. S. Army Engineers' operations on the Inter-American Highway would be resumed late in September (*ENR*, Sept. 27, vol. p. 407), the committee has now decided to postpone resumption of the hearings until two other federal organizations now concluding their own investigations have completed their reports. The two groups are the Inspector General's office of the U. S. Army, and the Department of Justice. Both expect to report soon on their findings.

Approval of the United States agreement for improvement of the St. Lawrence Waterway is provided in bills introduced recently in both houses of the Congress. The measures authorize the President to negotiate with the Power Authority of the State of New York regarding transfer to the authority of certain power facilities constructed pursuant to the passage of the bill. He is also authorized to work out an agreement with the authority to permit the latter to use the United States' share of the waters of the St. Lawrence, the authority being required to pay the U. S. $93,375,000 over a 50-yr. period. Passage of the bills would put the 41,000,000 projects up to the Canadian Parliament.

The U. S. Army Engineers are now awarding contracts for military construction on a competitive basis. This departure from the wartime practice of letting such contracts on a strictly negotiated basis (*ENR* June 7, 1945, vol. p. 793) has been made possible because of the tremendous drop in army procurement, the relaxation of delivery schedules and the consequent increase in competition for business. Normal bidding methods on civil works construction projects of the Corps of Engineers was resumed some weeks ago, (*ENR* Aug. 23, vol. p. 216).

A bill (H.R. 4083) has been passed by the House authorizing the U. S. Army Engineers to improve the Savannah, Ga., harbor and Agate Bay Harbor at Two Harbors, Minn. The former project is estimated to cost $2,738,000. A similar bill (H.R. 3477) was passed in the last session of Congress, but was vetoed by President Truman because the measure did not specify that the work could not be started until the war emergency was declared ended.

JOBS OF THE WEEK

RESIDENCES, San Mateo, Calif.

San Mateo Investment Co., A. Johnson, president, San Mateo, will construct 800 residences by its own forces. The estimated cost is $10,000,000. E. P. Wilsey, Hillsborough, is the engineer.

POWER PLANT, Hagerman, Idaho

Morrison-Knudsen Co., Inc., Boise, will construct a power plant for Idaho Power Co., Boise, to cost about $2,500,000, including equipment. H. L. Senger is chief engineer for company.

FACTORY, Elyria, Ohio

The Austin Co. has been awarded a contract to build a factory and office for Brown Lipe Chapin division of the General Motors Corp., Syracuse, N. Y., to cost about $3,000,000. Albert Kahn Associated, Engineers and Architects Inc., is the engineers and architects.

HIGH PRESSURE GASOLINE PLANT, Carthage, Tex.

Chicago Corp., care of the Tennessee Gas & Transportation Co., Houston, Tex., has awarded a contract to build recycling or high pressure gasoline manufacturing plant to Stearns-Rogers Construction Co., Houston at an estimated cost of $3,000,000.

PLASTICS PLANT, Coshocton, Ohio

The Austin Co., Cleveland, has been awarded a contract for a laminated plastics plant for the General Electric Co., Plastics division, Pittsfield, Mass., at $4,706,204.

Note—Additional bidding and contract news on many projects large and small, including the above items, appear in the Construction News section beginning on page 205.

OBITUARY

James M. Denney, Philadelphia, Pa., civil engineer, died Sept. 17. He was a graduate of Pennsylvania Military College and Cornell University. His engineering activities included construction of the first electric street railway in Harrisburg, Pa.

Frederick S. Foulkrod, civil engineer and member of the construction engineering firm of Hughes-Foulkrod Co., Philadelphia, Pa., died Sept. 22. He was a graduate of the University of Pennsylvania, and a former director of the Burlington-Bristol Bridge.

Calvin Ellsworth Snyder, 58, died at Memphis, Tenn., Sept. 9. As county engineer for Lauderdale County, Tenn., Mr. Snyder planned the construction of several roads and highways. After employment as a civil engineer with the United States Engineers, West Memphis, Ark., he returned to Ripley in 1939 as city engineer. More recently he was a project evaluator for the Home Loan Corp.

Harry A. Sparks, 67, died Sept. 24 in Xenia, Ohio. He retired two years ago after nearly 15 years with the Ohio highway department. Before that he was city engineer at Xenia, and service director of Lansing, Mich. Known as an authority on asphalt road material, Mr. Sparks developed several types of surfacing that have been widely used.

Kirkwood A. Pritchard, civil engineer, of East Cleveland, Ohio, died Sept. 25 at Charleston, W. Va., where he was field construction superintendent for the Carbon and Carbide Chemical Corp.

Roy E. Ross, 63, of Westfield, N. J., eastern district manager of Bates & Rogers, heavy construction contracting firm, died in Chicago, Ill., Sept. 28.

Atom producers get "E"

With secrecy restrictions somewhat lifted, work of builders and operators of the atomic separation plants is being recognized by presentation of the Army-Navy "E" Award. In ceremonies at Oak Ridge, Tenn., on Sept. 29, awards were made to: Clinton Laboratories of the Monsanto Chemical Co.; H. K. Ferguson Co. and its operating subsidiary The Fercleve Corp.; Ford, Bacon & Davis, Inc.; J. A. Jones Construction Co., Inc.; The Kellex Corp., a subsidiary of the M. W. Kellogg Co.; Stone & Webster Engineering Corp.; and Tennessee Eastman Corp.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Influence Lines

Sir: I have read with much interest the article of Prof. Posey on influence lines for continuous beams (*ENR* Dec. 16, 1943, vol. p. 911). In spite of existing tables, the engineer sometimes has to plot influence lines himself, and then the question arises which to choose of the various methods by which influence lines can be calculated or constructed. For it makes a difference whether one needs the correct ordinates or whether a quick but more or less approximate result will do, also whether the influence lines have to be plotted for many sections or for a few.

Instead of Prof. Posey's formula $f = tx^3/l^3$ for the calculation of the ordinates of the elastic line (due to the support moments only), these ordinates may be calculated as well directly from the formula (notations as per Fig. 1):

$$y_s = ab[(1+b)M_p + (1+a)M_q]\frac{l^2}{6EI}.$$

E and I are the modulus of elasticity and constant moment of inertia.

Mr. A. A. Eremin (*ENR* April 6, 1944, vol. p. 459) was in favor of graphical solution, and although formulas are useful for checking the results of the construction (e.g., of the main tangent points), I agree that the graphical solution is very attractive; i.e., if done properly.

We can use the fact that a local deformation produces a moment line consisting of straight lines, thus giving triangular moment areas. By first taking triangular areas with a base equal to the corresponding span length we can draw an initial link polygon. This link polygon is gradually detailed by drawing secondary links, giving as many tangent points as are required to finish the elastic line with a French curve. Since the initial link polygon automatically produces the fixed points of the spans, the construction can be used for plotting the fixed points in advance. This is very important, because in doing so we not only avoid much unnecessary adjustment of the link polygon during the process, but the fixed points permit evaluation of the ratio between the support-moments due to the local deformation in such a way that we do not have to calculate these.

The first fixed point is at the end of the beam for a free supported end and $\frac{1}{3}$ of the span for a fixed end. The other fixed points are found in succession, as shown in Fig. 3.

The easiest way is to start with the influence line for a reaction. The support is dropped and the initial link polygon started from both ends of the beam till both parts meet. This polygon reveals the ratio between the support-moments; the latter then are used for detailing the link polygon. We take advantage of the fact that the point of zero moment are points of contraflexture of the elastic line.

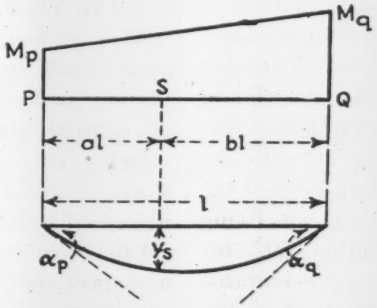


Fig. 1. The ordinates of the elastic line of an unloaded span can be expressed in terms of the support moments.

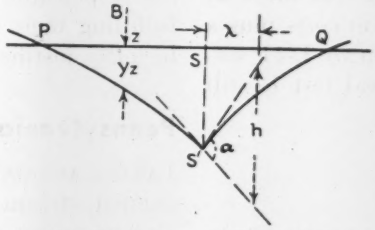


Fig. 2. The angle turning (local deformation) is measured by the tangents to the elastic (influence) line.

The solution for shear and moment influence lines is based on the same considerations, only the influence line for reaction is a *continuous* line and those for shear and moments are not; these are broken at the point where the local deformation is introduced. Prof. Ir. C. G. J. Vreedenburgh of the University of Delft (Holland) however, showed (*Ing. Ned. Indië*, 1935, no. 10 and 1936, no. 8) that the influence line can be made continuous again if we measure the ordinates from the deformed axis of the beam. Eventually we have to do this only in the span where the local deformation is introduced, and if desired, the ordinates afterwards can be adjusted in the normal position. By taking the deformed axis of the beam, the link polygon can be started between the fixed points and then extended to both ends of the beam, which procedure saves a great deal of time and is more accurate.

Finally, I have to remark about the scale of the influence line. In the case of the influence lines for shear and reaction, the scale of the influence line is revealed automatically. This is not the case with the moment influence line. According to Fig. 2, the moment M_{ss} at point S due to a load B at point Z is expressed by

$$M_{ss} = B\frac{y_z}{\alpha} = B\,y_z\frac{\lambda}{h}.$$

In this formula y_z and h are moment ordinates and λ is a length. If B, λ and h are the units, then $M_{ss} = y_z$, so h at a distance of the unit of length from S represents the unit of scale of the moment ordinates.

L. A. ALTING MEES
Cape Town, South Africa

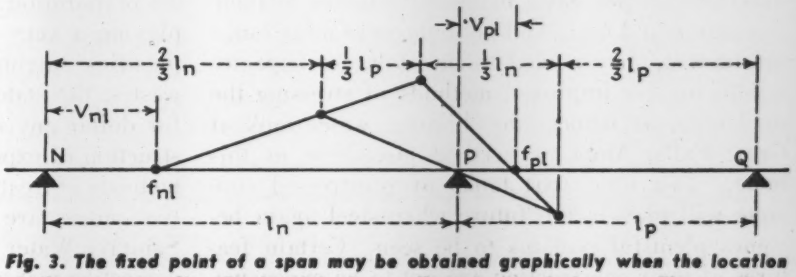


Fig. 3. The fixed point of a span may be obtained graphically when the location of the corresponding fixed point of an adjacent span is known. The construction for two spans of constant moment of inertia is illustrated.

EDITORIALS

VOLUME 135 NUMBER 14

October 4, 1945

Beyond L-41

FEW PERSONS in the construction industry failed to applaud the news that WPB will revoke its famous L-41 order on Oct. 15, and rightly so, since any attempt to allocate materials to a multitude of peacetime projects or to control the character of construction could only result in confusion, unfairness and failure. Yet it should be recognized that the action merely removes the threat of an unworkable procedure, and actually does nothing toward solving the main problem, which is to make building materials available fast enough to avert an inflation in construction costs and a consequent deflation in construction volume. To solve this problem, the federal authorities have chosen the difficult and untried path of holding prices under a ceiling until supply catches up with demand, probably a justifiable attempt in view of the dangers of a runaway inflation. But it means living with OPA Maximum Price Regulation 592 for some months to come, and it requires a considerable amount of self-discipline on the part of manufacturers, contractors, labor, real estate interests and banks to forego temptations to beat the rules. An equal requirement, of course, is that those in charge keep ceiling prices adjusted to costs plus a fair profit. In any event, revocation of L-41 was only a minor development. The real test is still to come.

Prestressed Concrete Tanks

ALTHOUGH CONCRETE TANKS with prestressed reinforcement have been built in increasing numbers for a decade, wartime scarcity of steel plates and structural shapes gave an added impetus to their acceptance and use. And not only were more tanks constructed, they tended to be of larger capacity and to involve improved methods of stressing the steel rods, as witness the 4¾-mg. water tank at Great Falls, Mont., described elsewhere in this issue. Just what part tanks of prestressed concrete will play in the future when steel again becomes plentiful remains to be seen. Certain features of their construction are apt to be expensive, such as the enormous amount of timber scaffolding needed to support large-diameter thin shell dome roofs (80,000 b.ft. at Great Falls); the extra precautions required and the man-hours of labor needed to tighten properly the prestressing bars; and especially stable foundations. On the other hand, maintenance costs may be more with steel, and there are many who believe that the advantage architecturally is with concrete. In any event, the two types of structures are competitive enough to assure continued efforts at design and construction improvements on the part of proponents of each.

Toward Dependable Labor Conditions

THE ACTION of New York construction workers and employers in agreeing on mutual concessions, to be followed by stabilization of wages and working conditions for sometime to come, as outlined in the news pages of this issue, will eliminate some of the contingencies that have forced contractors to bid high to cover uncertainties. If the agreements can be consummated, and are approved by the appropriate federal agencies, our largest metropolitan area can be expected to benefit not only by a quick start of more construction, but from more stable and, therefore, more efficient operations. While one of the immediate objectives is increased hourly wages for men suddenly cut from 70 to 40 hours weekly pay, there is good reason to expect that, over the long pull, economy will result since the expensive changes in practices that might occur from piecemeal negotiations will be avoided. If the workmen and their unions accept the responsibility, long expected of employers, in fulfilling their contracts, the increased wages can be fully justified.

Pennsylvania Shows the Way

LATEST ACTION in a series of aggressive moves to combat stream pollution in Pennsylvania is the announcement (p. 91) by that state's Department of Health that it is prepared to make 50 percent grants to municipalities and private industries for the preparation of treatment plant plans. And displaying a very realistic appreciation of the complexities surrounding the handling of industrial wastes, the state authorities offer to match dollar for dollar any industry's contribution for the construction of experimental works where satisfactory methods of treatment are unknown. These constructive moves are highlighted by the action of the Sanitary Water Board in issuing orders for stream corrective measures to a number of industries and more than 300 municipalities over the past two

years. Thus, the ending of the war finds the state authorities already far advanced in their program, and now with an appropriation of $4¼ million substantially more progress can be realized. What Pennsylvania is doing to improve sanitation and pollution abatement should be a stimulus and guide for action in other states.

Filtered Water for Chicago

CONGRATULATIONS and good wishes from the waterworks world go to Chicago on the opening of its treatment plant (*ENR* Sept. 27, vol. p. 403). The hum of centrifugal pumps that signalled the start of operations was sweet music to the city engineers who have been engaged on the construction of this plant since 1938. Actually, however, the project had its genesis a decade before this when experimental work was undertaken to determine the most effective means of treating Lake Michigan water. In the seventeen years that have elapsed, a multitude of problems had to be solved involving public health, chemical, hydraulic, structural, financial, legal and civic planning considerations, topped off with the added difficulties of carrying on construction in wartime. Chicago has reason, therefore, to feel great pride at the inauguration of its first water treatment plant. Operation of this facility—the world's largest—will bring a higher standard of service to its citizens. To the profession it offers opportunity to study the latest developments in water supply practice.

Airship Hangar Failures

THE COLLAPSE under hurricane winds of the three timber airship hangars at the Richmond, Fla., naval air station on Sept. 15, was an event of wide engineering significance, raising questions not only of the suitability of timber for structures of such magnitude, but also of the adequacy of our most advanced wind design procedures where varying combinations of pressure and suction forces must be resisted. That the Richmond hangars were well designed, cannot be doubted, unless and until contrary evidence is brought forward, for the Navy's Bureau of Yards and Docks has competent designers, who, moreover, are known to have regarded the problems presented by these hangars with great respect. It is precisely for this reason, that the failures offer a rare opportunity for profit to the profession. As a consequence, it is to be hoped that the Navy board of inquiry will lose no time in making its complete findings known. To that may also be added the hope that the Navy authorities will give the Bureau of Yards and Docks a free hand in providing the profession with information on any of the more detailed structural aspects of the failures that may not be a part of the report. Like the Quebec Bridge and the St. Francis Dam, the Richmond hangars may, by their failure, lead to greater structural safety and improved construction practices. In any event, every effort should be made to wring the last ounce of benefit from their unfortunate collapse.

Not-So-Secret Weapons

AMERICAN CONSTRUCTION equipment was a powerful weapon the enemy did not have. Yet it was no secret. our manufacturers, in fact, having long tried to sell their wares abroad before the war. But our enemies failed to see the military value of our rugged construction machinery, which in the skilled hands of our Navy construction battalions and Army Engineers stood up under the rush, strain and neglect of war, just as it had under tough going at home. It is to the everlasting credit of the manufacturers and their employees that they had built into the equipment the stamina to withstand the rough usage of war.

Bulldozers got the big play during war construction, for these versatile machines caught the public fancy, just as did the bouncing jeep. But bulldozers were merely symbolical. The shovels, cranes, scrapers, graders, rock crushers, asphalt and concrete plants, rock drills, compressors, welders, generating plants, pumps and trucks and all the other equipment items played an important part in building for battle.

Now construction equipment manufacturers are preparing to beat their swords into plowshares. For the most part this involves merely changing the shipping tags, although some new machines will no doubt make their appearance. In any event, equipment—good equipment and enough of it for any size construction program—is going to be available. That promise is written in the war record of the entire American construction equipment industry.

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Okinawa Was Ready

Harold W. Richardson
Western Editor, Engineering News-Record
(By Air Mail from the Pacific Theater of Operations)

***Editor's Note**—End of hostilities found Okinawa in the midst of probably the greatest war construction project of all the forward areas—a project whose speed and magnitude represent the culmination of nearly four years of front-line construction by the Army Engineers and Navy Seabees. It was fitting that this last big job was a joint venture by the two construction services. The following account was written on Okinawa after a first-hand inspection by the author, who spent the closing days of the war on that island. It depicts the construction situation there just as peace came.*

WHEN HOSTILITIES CEASED in the Pacific on Aug. 15, Okinawa was ready as a great forward airbase. The war ended 4½ months after the invasion, but during that time, of which the first 82 days were devoted to heavy fighting to make it secure, the sleepy Oriental island dominating the East China Sea witnessed one of the greatest construction operations of the war. Work was under way on 12 airfields, including one on the nearby small island of Ie Shima, and at the end of the war 15 runways, totaling 19 mi. in length, were ready for operation on 11 of these fields. Also in operational stage were 59 mi. of taxiways and 823 hardstands for parking planes. These were all coral-surfaced, though coral is relatively scarce on the island, and in some cases must be hauled as far as 7 mi.

The runways, from 5,000 to 7,500 ft. long, with graded extensions on each end, accommodated every type of military plane from fast fighters to B-29 bombers and the big C-54 and R5D transports. During the final phase of the battle the Nip homeland felt the sting of many Okinawa-based planes. At times construction speeds were fantastic, as is evident by the building of a 200x7,500-ft. strip at Bolo Field in exactly 30 days.

Airports, of course, are only part of the construction program. By Aug. 15 there were 379 mi. of main road completed, of which 198 mi. were reconstructed from existing narrow Jap roads, all coral-surfaced. In addi-

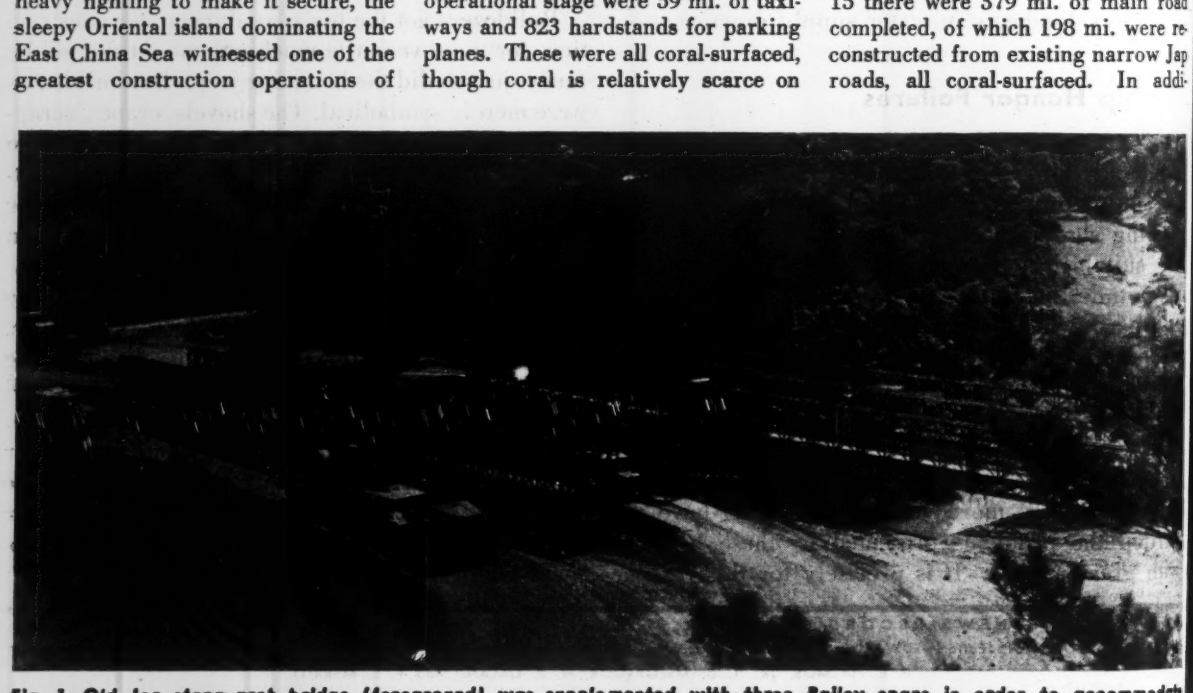


Fig. 1. Old Jap stone arch bridge (foreground) was supplemented with three Bailey spans in order to accommodate the heavy U. S. military traffic on the island.

tion, there probably have been another 350 mi. of roads built through ramps and storage areas. A two-ramp seaplane base has been completed on the shores of Buckner Bay. Twelve piers are in operation, mostly the floating pontoon cell type, but much of the cargo reaching the island is still being unloaded by lighters and amphibious trucks. Dredges are at work to increase the harbor facilities, while 100 sunken hulks have been cleared from Naha Harbor, with almost as many remaining to be removed.

Extensive gasoline and oil storage and handling facilities have already been installed. Bomb and ammunition dumps cover thousands of acres. Water supply so far is largely local, though several extensive developments are under way.

All this has taken place on an island that was not even in the tactical plan ten months ago. Original intentions were to take Formosa and Amoy (on the China coast), but better beaches for landing, more suitable topography for airfields, and the prospect of a big base 350 mi. nearer Japan led to a change in military plans last October.

Up to now all construction has been mostly temporary in character, of the types just sufficient to meet minimum requirements. Roads and runways are coral-topped, though a few heavy bomber strips were given a primer shot of asphalt and sealed with sand. Highway and airport

Fig. 2. Okinawa's strategic airbases are largely concentrated in the south part of the island. Naha, Buckner Bay, and Chimu Wan are principal harbor developments. The large native population has been moved to the mountainous northern sector.

drainage is largely open ditch with few culverts. Hastily-erected Bailey bridges replace wrecked Jap spans. Housing, hospitals, shops, administration offices and covered storage consist, for the most part, of tents. Very few Quonsets or framed buildings have been erected. Light and power is provided by portable generating sets. Telephones are still Signal Corps field equipment. The end of the war found Okinawa just beginning to build for semi-permenancy. Materials for the job are on the ground or in ships lying at anchor or en route to the island.

All construction on Okinawa has been a joint, cooperative venture by the Navy Construction Battalions and the Army Engineer Aviation Battalions and other types of army engineer units. The military show was also a joint Army-Navy affair, with the newly-formed 10th Army, consisting of one Army Corps and one Marine Corps, doing the ground work, supported by the fleet, carrier-based planes and the Marine air forces.

In other forward areas there has been direct construction cooperation between the two services, but nothing like that achieved at Okinawa. Commodore A. G. Bisset (CEC) USN, commander of the 10th Naval Construction Brigade, was named Commander of Construction Troops at Okinawa in the early days of planning, long before the strike against the island. He also remained in command of his brigade.

Both army and navy engineers were appointed to Commodore Bisset's staff. The key personnel includes Col. Lyle Rosenberg (CE) USA, commander of the army Third Provisional Construction Brigade and Island Engineer of Okinawa, who was named Deputy Commander in charge of all army construction troops; Commodore C. C. Seabury, commanding the 8th N. C. Brigade; Commodore W. B. Short, commanding the 11th

Fig. 3. Gullies 40 ft. deep could not slow up construction of the big air fields at Okinawa. Large stones from the quarry-run coral base material were pushed to one side of the runway.

Fig. 4. Military traffic bogged down on the narrow, dry-weather Jap roads.

N. C. Brigade; and Capt. R. N. Harris, deputy commander, 10th N. C. Brigade. As staff engineer for the 10th Army, Brig. Gen. George J. Nold also took an active part in construction planning and operations.

On Aug. 1 military control of the island passed to the Army under Gen. MacArthur, though the joint construction staff, with Commodore Bisset in charge, remained as before. There has been a gradual change in plan of operations, however. Up to the date of change of overall command, army and navy battalions worked indiscriminately, often side by side on the same project. Lately there has been a tendency to assign army units to projects solely for army use, while the Seabees are looking after Navy installations.

A few Seabee and Army Engineer battalions landed with the assault forces. Others came in with following echelons, and the increase has been steady until now there are more than 100,000 construction troops on Okinawa. These are divided about equally between the Army and Navy. This is probably the greatest concentration of construction forces ever gathered together at a forward base. The number is constantly changing, however. Some additional battalions are still coming in, while other units are leaving to go forward with occupational troops.

Plenty of equipment

A construction force of 100,000 needs plenty of equipment, and they have lots of it on Okinawa. No construction man will ever admit he has enough equipment on hand, nor will he ever be satisfied with his stock of spare parts, but observation of the various operations reveals no serious shortages in any type of machines. A recent check shows 6,335 pieces of major equipment at work on the island, about equally divided between army and navy units. The detail list is given in the accompanying table. This list is changing every day, but the total number of units is steadily increasing with each arriving echelon of shipping.

Investigation reveals that less than 10 percent of all heavy equipment is in the shop or on the deadline. Most of it was new or rebuilt to new standards when it arrived. Experience in other campaigns has resulted in excellent repair and spare parts facilities, which keep the equipment rolling.

Of course, in addition to the above list of heavy equipment are thousands of lighter items, such as pumps, compressors, rock drills, generating plants, water treatment plants, shop and repair equipment—all classed as Engineer and Seabee equipment.

Jap occupation lasted 200 years

Okinawa once belonged to China, but the Japs invaded the island about 200 years ago. For more than a century it was governed jointly by the two nations, but at the close of the Sino War in 1894 Japan took over completely.

In this 200-year occupation the Japs contributed little to the development of the island, and despite its strategic military location their fortifications consisted only of four airfields and a network of narrow roads. Some work had been done on additional airfields, but none of these was usable. Apparently little attempt was made to develop the island for naval operations, for the harbor works were limited to small anchorage and berthing facilities at Naha and a submarine base, part of it underground, at Unten Ko.

Okinawa is 67 mi. long, varying from 4 to 10 mi. wide. It contained a population of 435,000, a polygot mixture of natives, Japanese and Chinese, largely concentrated in the south half of the island where the terrain is more suited to agriculture. The thinly-populated northern half is much rougher in topography, though practically the entire native population has now been moved to that area.

Fig. 5. Heavy rains messed up the improvement operations on Jap roads in the early days of the Okinawa campaign.

There were only three cities of appreciable size: Naha, the recent capital on the southwest coast, was apparently a fairly modern city of 66,000 population. Shuri, the ancient capital, population 17,000, lies only 4 mi. to the east atop the rugged limestone escarpment that cuts across the south part of the island, and which proved to be a stubborn enemy stronghold in the final days of fighting; Shuri was completely wrecked by the battle. Toguchi, the third city, with a population of 20,000, is on Motobu Peninsula, out of the important fighting zone.

Industry on the island

Industry on the island was limited to small-scale sugar and alcohol manufacturing. There was a 30-in. gage steam railroad running a few miles in three directions out of Naha, but the most unusual railroads were an extensive system of horse-drawn cars operating over tracks laid on most of the roads throughout the island, necessary because the roads were impassable in wet weather. Naha was served by an electric power plant, and by a well and gallery water supply system that included three filter beds, 30 mi. of mains and yielded 400,000 gpd. Once Naha even boasted a street-car line, but it was dismantled in 1939. During the fighting Naha was completely demolished, and its narrow harbor became another Iron Bottom Bay from the ships we sunk and the Japs scuttled.

Existing Jap airports

Four enemy airports were in operation at the time of our invasion: one at Ie Shima, and at Yontan, Naha and Kadena on Okinawa. Yontan had three landing strips, Ie Shima two, and each of the other fields had one only. The runways varied from 4,300 to 5,100 ft. long and 160 to 260 ft. wide, except the Naha strip was 500 ft. wide. Apparently this was to have been a big bomber field, for a second diagonal strip 670 ft. wide had been started. All the runways and taxiways were lightly surfaced with coral, but were poorly built with little drainage. Strictly dry-weather fields, all the Jap strips had to be entirely rebuilt for our use except that at Naha, which we are using pending completion of a runway of our own.

The existing highway system was extensive, but miserably poor according to our standards. No road was wider than 16 ft., most of them were only 12 ft., while many were just 6-ft. cart trails. Main routes were topped with coral, spread very thin and wholly inadequate, as we soon found, for heavy automotive traffic. Bridges were stone masonry arches, except for a few recently-built concrete structures. As there are no large streams on the island, the bridges were correspondingly small.

Fig. 6. Narrow Jap roads gave way to wide, coral-surfaced highways when our heavy equipment got to work.

Native masonry on the island

The Oriental mania for conserving space was evident in the road system. Where fills were necessary, rather than let the toes spread out over land that might be cultivated, the road-builders had laboriously erected cut-stone retaining walls. The same idea was applied to narrow cuts, which were all faced with stone to avoid widening to natural slopes. Okinawans had developed a remarkably high skill in stone masonry, as evidenced by the highway work, by miles of stone seawalls protecting low-lying ground, and by the seawalls and quays at Naha harbor. Two ancient castles, elaborate affairs with scores of open courtyards connected by stone archways, are further examples of fine masonry. Apparently, in only recent times was cement mortar used, for most of the masonry is dry laid, each stone cut to fit in its place. Many a stone from wrecked walls, patiently quarried and cut by hand ages ago, was tossed into rock crushers by our

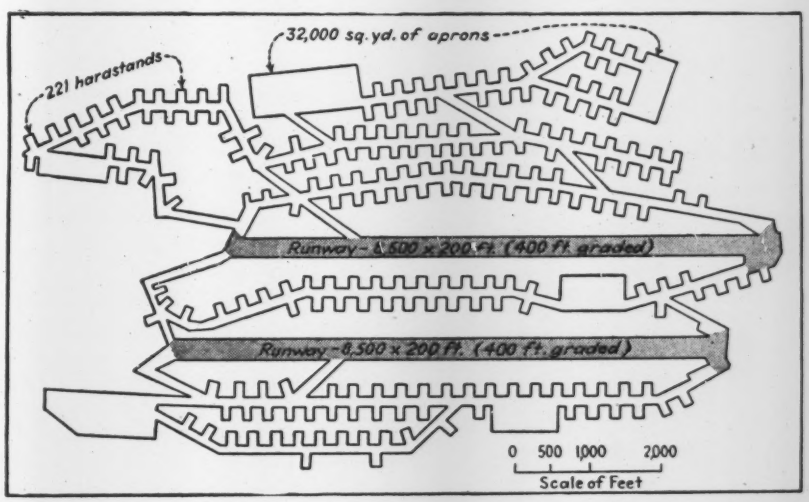

32,000 sq. yd. of aprons
221 hardstands
Runway - 8,500 x 200 ft. (400 ft. graded)
Runway - 8,500 x 200 ft. (400 ft. graded)
0 500 1000 2000
Scale of Feet

Fig. 7. Runways, even if they are 8,500 ft. long, are only a small part of a forward base airfield for long-range heavy bombers. This is a typical layout of an Okinawa airport.

Fig. 8. Narrow Naha Harbor was choked with some 200 sunken Jap ships, most of which have now been removed. The cleared space to the left, once a part of the city, will be a huge storage depot.

construction forces as an emergency source of road surfacing material.

How we took Okinawa

Our invasion troops landed Easter Sunday, April 1, on beaches along the west side of the island north of Naha. Press reports said the landing was unopposed, and progress made the first two days was that not expected for a week or more. So it was, in fact, we took both Kadena and Yontan airfields that first day, we cut the island in two the second day. Bombed-out Yontan and Kadena were supposed to be operational the fifth day. They were, though a crippled carrier-based Marine plane landed safely on Yontan the third day amid bomb craters and construction equipment.

True, no intensive opposition of the landing developed, and the reports sound as if the push was easy. Probably it was in relation to what was expected, but no mention was made of the terrific air attacks against the later echelons waiting just off shore for their turn to land. No mention was made of the struggle the construction troops had in getting their equipment ashore amid Jap strafing and bombing and artillery shelling while LST's and even smaller craft were hung up on coral reefs helpless at the mercy of the enemy ashore and aloft.

Furthermore, nothing was said of Engineers and Seabees having to defend the airports once they were taken by the assault troops. No correspondent bothered to write up the difficult job of rehabilitating captured airports under constant sniping and bombing and artillery fire. The construction troops not only had to build, they had to defend themselves and their works while doing it.

At first the campaign proceeded according to schedule. We expected to split the island, seal off the north end and clean out the south half. Actually, because of few enemy troops encountered, the Marines kept right on going north and secured that part of the island in short order. On April 16 we invaded Ie Shima to gain the use of its fighter strips which had been neutralized by our air forces. Ie was secured in a short time.

The Army turned to the south—and was stopped cold for weeks. Machinato airport was captured, but could not be used or even repaired because it was within easy range of Jap artillery in the hills. We found the enemy, estimated at 90,000 strong, entrenched in caves in the limestone escarpment to the south.

Terrain ideal for the Japs

The rough and rocky terrain was ideal for the Jap method of fighting from caves. They lived and fought underground to an extent never believed possible. Their stores and gun positions and even planes were hidden in caves. We lined up our artillery almost hub to hub across the island and blasted away at the escarpment constantly for 10 days and nights. Warships offshore threw thousands of tons of shells into the area. Our aircraft dropped more thousands of tons of explosives in probably the greatest barrage in history. At the end of 10 days our troops moved forward confident that no living thing could survive that barrage. We were fooled, for the Jap cliff dwellers met us with murderous fire. It took a month of hand-to-hand fighting and blasting each cave with liquid fire or explosives to crack that line, to take Naha and to end all organized resistance.

Meanwhile, the construction troops worked desperately to make and to keep the captured Jap airfields operational, to extend the runways to accommodate our fast fighters and medium bombers, to keep those miserable Jap roads open, to build new roads when the old ones gave way, to replace bridges as fast as enemy bombers destroyed them. They had to provide more and more cargo handling facilities, and develop water supplies for the embattled troops. The rains came incessantly, bogging down equipment, hampering movement of supplies and evacuation of the wounded.

Building under difficulties

Equipment operators at work on runways faced a double hazard—the enemy and our own planes. Aircraft simply had to land and to take off of usable parts of strips while the runways were being extended or completed. Many a plane crashed into bulldozers, scrapers and graders, often with fatal results to both operator and pilot. Yet despite all difficulties and hazards, runways long enough and solid enough to accommodate the big C54 and R5D transport planes were ready before the battle was over. These big craft saved many a wounded soldier's life by speedy evacuation back to base hospitals on Guam.

Coral for topping runways, taxiways, hardstands and roads was, and still is, a critical item. Without it, planes and trucks and jeeps and ambulances bog down in the deep Okinawa mud. The island is out of the Pacific coral zone. There are no coral beaches of excellent surfacing material as was found in the South Pacific. There are no outcrops of easily-quarried coral rock as there are at Guam, Tinian and Saipan. Coral on Okinawa is relatively scarce, and is old and hard, most of it requiring drilling and shooting. Poor as it is,

e coral limestone is the only avail-
le rock on the island. So rock
arrying and hauling were pushed
the limit of all available equip-
nt. Operations continued during
raids right up to the point where
r own anti-aircraft guns started
ooting and the rock crews had to
d cover, usually under their equip-
nt, to escape our own falling flak.
Of course, in the early days of the
mpaign construction operations
re concerned solely with the fight
make the island secure, but before
g work was started on the real job
construction, that of preparing an
rbase from which to strike Japan
d East China. This phase of the
rk was well under way by June 21,
date the island was proclaimed
cure. This term "secure" is only a
lative one, as the construction
rces soon learned. Organized fight-
g ends, but air raids, guerilla war-
re and sniping continue. In fact,
en now, after the end of the war,
iping from stray Japs still living in
lated caves still goes on, as it prob-
ly will for some time to come.

Big airport program planned

At the end of the war construction
s under way on 12 airports, whose
cilities were to include 21 runways
ggregating 29 mi. long, 125 mi. of
xiways, 2,500,000 sq. yd. of aprons,
d 2,128 hardstands, gas and oil
rage for 2,800,000 bbl., and 1,620
ops, warehouses and hangars. Five
these fields are located at the sites
old Jap airports (including Machi-
to, never completed by the Japs),
t the original runways have been
gely obliterated by the new fields.
hen the war ended no field was en-

BIG EQUIPMENT ON OKINAWA

Item	Navy	Army	Total
Scrapers w. tractors, 8 yd.	20	97	117
Scrapers w. tractors, 12 to 15 yd.	306	140	446
Motor graders	124	206	330
Pull graders	60	43	103
Rollers, road and sheepsfoot	125	177	302
Shovels, 1/2 and 3/4 yd.	70	95	165
Shovels, 1 1/2 to 2 1/2 yd.	65	27	92
Tractors w. bulldozers, Cl. 1	330	182	512
Tractors w. bulldozers, Cl. 2	140	396	536
Dump trucks, 6x6 2 1/2 ton	1,650	1,371	3,021
Dump trucks, 6x6, 4-ton	80	580	660
Dump trucks, 2x4, 15-ton	51		51
Total	3,021	3,314	6,335

tirely complete, even as to grading and surfacing, and very few buildings had been erected. Yet there was in operation a total of 15 runways on 11 airports, some 7,500 ft. long, having an aggregate length of 19 mi. About 59 mi. of taxiways and 823 hardstands were also in service.

Kadena, Futema and Bolo (see map) airports were designed as VLR (long range) for B-29 bombers, each with two runways 200x8,500 ft. The 200-ft. width indicates the planned asphalt paving (none has been placed) and does not include 100-ft. graded and coral-topped shoulders on each side. One strip each at Kadena and Bolo were operational for a length of 7,500 ft., and one Futema runway had been completed to 6,500 ft. long. Planned taxiways on these three fields were to be 55,000 ft., 44,000 ft., and 62,000 ft. long, respectively, and hardstands were to total 246, 180 and 221. About half the taxiways and a third of the hardstands at Kadena and Bolo were in operation when the war ended.

Yontan, two runways 150x7,000 ft. (excluding 75-ft. shoulders), Motobu, with two strips 100x7,000 ft. (plus 50-ft. shoulders) and two 150x7,000-ft. strips at Ie Shima were designed for heavy bombers (B-24's). All of these, except one runway at Motobu, were in operation. Machinato was revamped into a medium bomber (B-25 and A-26) field with two 100x6,500-ft. runways replacing the original shorter Jap strips. One of these was in use at the end of the war.

Two of Ie Jima's four runways, and single strips at Tera, Awase and Chimu were planned for fighters. They vary from 100 to 300 ft. wide, the latter for side-by-side takeoff, and from 5,000 to 6,000 ft. long. Tera and one strip at Ie Shima were just started; the others were in operation.

Yonabaru is a special field built for the Naval Air Transport Service. It's 150x7,000-ft. strip was just completed, ready for operation, but as terminal facilities are still lacking it is not yet in service. The last field, Naha, is also a special project, designed for Army Air Transport Command and as an army depot field in connection with the port of Naha. It will have a single runway 150x7,000 ft., being built diagonally across the old Jap strip which is in temporary use by the Army pending completion of the new strip.

Construction of each of these fields is a special problem because of topography, soil conditions, drainage and availability of coral. Quantities involved are enormous. For example, one big strip at Kadena required 1,500,000 cu. yd. of excavation and

g. 9. Coral is scarce on Okinawa, but leveling this hill near the Naha waterfront provides both space and base material r the big depot that we have had under construction there.

465,000 cu. yd. of coral. Subgrades are carefully compacted, and the coral base, also compacted, varies from 18 to 24 in. It is thinned out somewhat on the shoulders, but not much, for the Air Corps squawks loud and long if a plane breaks through and bogs down on the shoulder. The coral base serves as a wearing surface pending the application of asphalt.

Speed was the paramount factor

Seldom could the airport construction be carried out in the most logical manner, for speed was paramount, and making flying facilities available at the earliest possible moment for the greatest number of airplanes dominated the construction procedure. Sometimes the strips were built first to only part of their ultimate width in order that the smaller planes might use them sooner. Again, strips were completed to only a part of their ultimate length, and planes operated off the short runways while construction forces lengthened the ends of the strips. The long runways for the long-range bombers, designed for 8,500 ft., were stopped at 7,500 ft. as sufficient for temporary operation. Other runways were more important at the moment than that extra 1,000 ft. on runways that could be used without the extensions.

As fast as possible the strips are given a prime and seal coat awaiting an asphalt surface. Asphalt plants, along with adequate crushing plants, are just beginning to arrive. Crusher-run coral rock will make up the asphalt aggregate. Coral for the base is seldom crushed, as there is not sufficient equipment available. Therefore, big stones and rock in the quarry-run material must be bladed or bulldozed off to the side of the runways. No stone larger than one-half the thickness of the base is permitted to remain. Quarrying procedure is improving as more equipment continues to arrive. Well drills now supplement jackhammers and wagon drills on some of the larger projects. Shovels and trucks, working 24 hr. a day on loading and hauling have taken a beating ever since the early days when bombing took its toll as well.

Yonabaru and Awase were built in the soft muck of rice paddies near the shore. When dry, the muck makes a good sub-base. However, grading it up and getting it dried out sufficiently to take the coral topping was a big job, especially when heavy rains were a daily occurrence. Coral was hauled 7 mi. to Yonabaru over some roads that are narrow and steep. Both fields lie so low that their drainage is discharged into the sea through tide gates.

At Naha Airport part of the fill and base is finger coral, mixed with sand, obtained from the ocean floor. Here an expanse of the sea has been diked off and pumped out to expose and make available the fill material. It is handled to the runway by both scrapers and shovel-loaded trucks. A crushing and asphalt plant is now being installed on a nearby rocky island alongside of a big Jap gun whose barrel still points menacingly skyward toward Naha.

The extensive road network on Okinawa, largely confined to the south half of the island, is laid out around the existing Jap roads. There are three main north-south routes, one along each coast and one down the middle of the island, connected by numerous crossroads and branches. At one point where four main routes intersect a large traffic circle has been built "just like Stateside." A reconnaissance photograph of this circle under construction once led "Tokyo Rose" to warn her listeners against a new type of American plane that "will use a circular runway." No planes have used this circle as yet but a recent 24-hr. traffic count clocked 25,000 vehicles.

At first roadbuilding was confined mostly to improving the Jap roads. This meant widening out, tearing down the stone faces of the cuts, filling in the narrow side ditches and cutting new ditches of ample capacity, eliminating sharp turns and steep grades, and topping with coral. Trying to carry on such operations under combat traffic was a tough job. Bridges so far are temporary Bailey spans, usually placed over the gaps in wrecked Jap structures. Piles and piledrivers are beginning to show up, and the first pile trestle is now being driven. Fortunately, as the streams are small, bridge building is not a serious problem.

New roads are being built wide enough to accommodate two and three lanes of big military trucks, a few are four lanes. While not entirely built to PRA standards, these new routes are substantial in width and in coral topping. Drainage is mostly by wide ditches cut with scrapers, as culvert material is still scarce.

Plans call for asphalt surfacing of main routes, but this work has not yet started. Instead, the coral sur-

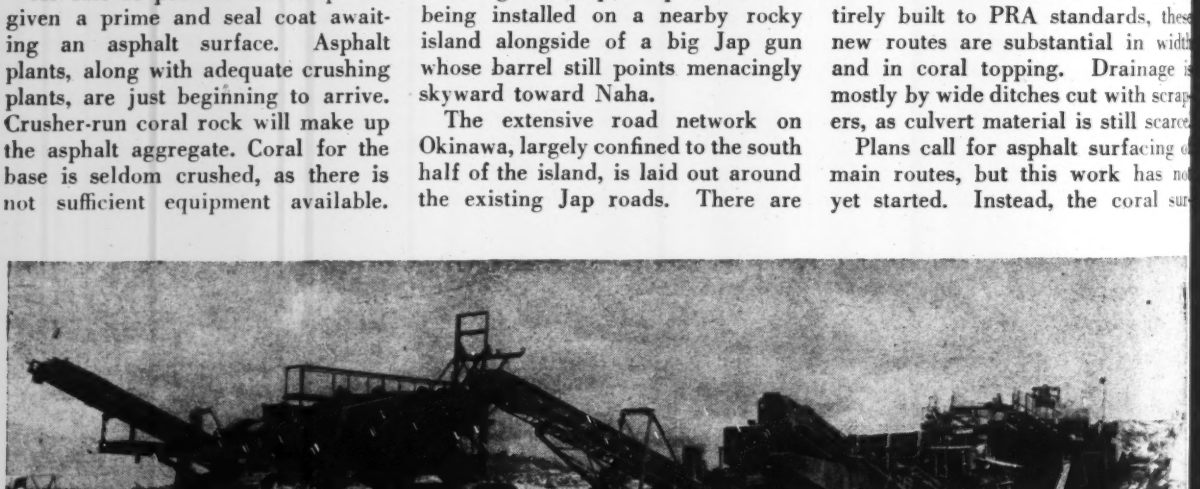


Fig. 10. As fast as possible crushing equipment is set up for production of runway coral surfacing, and aggregate for asphalt paving and concrete. All material is crusher-run, for screens are not available.

face is kept in shape by constant sprinkling with salt water and frequent blading. Mud tracked over the coral becomes a nuisance, for it is slippery when wet and dusty when dry. Where possible the mud is kept bladed off, but the maintenance frequently bogs down under sheer weight of traffic and the ever-lengthening road system.

Waterfront and other work

Dredges—hydraulic, hopper and clamshell—are just coming in to start a program of waterfront development. The best natural harbors are Naha and Baten Ko; the latter is a cove at the south end of Buckner Bay. Other parts of Buckner Bay are being developed, along with parts of Chimu Wan to the north and several places along the west coast. Piers are of three types: Floating pontoon cells, sheetpile filled with coral, and timber pile and deck. So far the pontoon type has predominated, as heavy floating equipment has been scarce.

At Naha harbor the big job now is raising 194 hulks of vessels clogging the entrance and berths. This work is about half complete at present. Meanwhile, driving of a sheetpile wall 300 ft. south of the present harbor channel shoreline, which will eventually become the new bulkhead line after the intervening ground is removed, is under way. Berths for five freighters will be built along this new wall. A quay is being built out over a stepped stone seawall for additional unloading space. Then, too, the old wharves, damaged very little by bombing, are being cleaned up for small craft landings.

The city of Naha, wrecked beyond all possibility of restitution, is being cleared of rubble and rubbish as the site of a big army depot. A few battered, but still standing, concrete buildings will be left as part of the covered storage facilities.

Water supply is still local in development, consisting mostly of spring and well sources. All water, both underground and surface, is highly polluted and must be thoroughly treated. The Naha supply has been partly restored, and the filters, though wrecked, are being repaired. A 6-mgd. surface supply will be developed on the Tengan River, a small but dependable stream. Two more large surface water developments are under consideration.

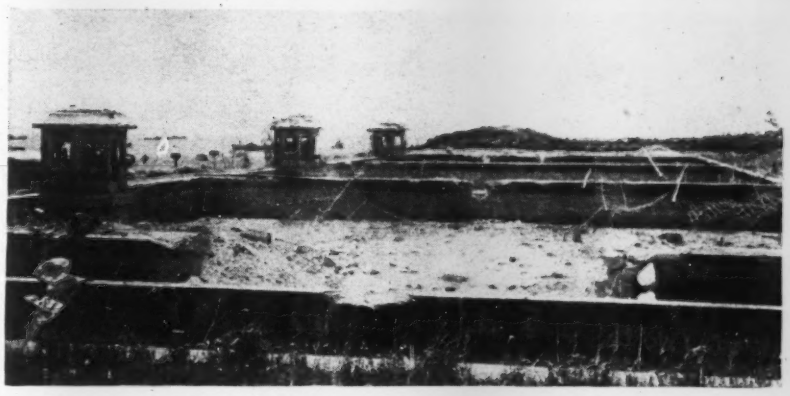


Fig. 11. Naha was served by a municipal waterworks that included these three sand filters. Partly damaged by bombs, the filters are now being restored.

The island is dotted with other types of military construction, such as hospitals, camps, administration offices, tank farms, depots, dumps, warehouses and shops.

Okinawa's future uncertain

Okinawa was ready, though not completed, as a great forward airbase to serve as the final springboard against the Jap homeland. The prime purpose of the island's development ended with the ending of hostilities, but the strategic military position of Okinawa has not changed. It is now, and can be just as long as we desire, a police station in Japan's frontyard.

Commodore Bisset and his staff, in consultation with top army and navy authorities on the island and in the Pacific theater, immediately reviewed the construction plans and progress at Okinawa at the end of the war. It was agreed that the island would serve as one of the main staging and supply bases for the army of occupation in Japan and Asia, as well as for the fleet. Therefore, the construction program was modified accordingly.

Work on facilities solely for combat purposes, such as the newly-started Tera airfield for fighter planes and some of the uncompleted bomber runways, taxiways and hardstands, has been discontinued, at least temporarily. Bomb and ammunition storage construction has been curtailed. The hospital program, originally calling for 22,000 beds in contemplation of invasions of Japan and China, has been cut down to 7,000 beds.

On the other hand, harbor facilities, main road work, plane transport terminals, semi-permanent housing, shops, storage depots, water supply, and completion of several major airports are being pushed. All of these will be needed to serve as part of the supply base. No money or effort is being wasted on features of no immediate value.

The ultimate disposition of Okinawa, of course, rests with Congress when it decides upon our peace-time military program and which of the forward bases fit into that program. If the American people deem it necessary for world peace for us to keep military control of the West Pacific, Okinawa would be an ideal base for that plan. Its strategic position in dominating both the Pacific and the East China Sea, its location close to the Asiatic continent and its possibility as a strong outpost for Guam and the Philippines all make it a strong forward bastion.

To convert the island to a permanent forward base would require comparatively little further expense and effort. The main work has already been done. Materials and equipment are on hand or en route to complete the job. Utilities, housing and buildings are the principal items left for completion. The buildings are largely Quonsets and prefabricated types—structures of little use back home. The harbor facilities must be completed for the task immediately ahead. The native population has already been shifted and relocated out of the military occupation zones.

Yes, Okinawa was ready, but it cost us heavily in lives and blood and sweat and money. Sober and careful consideration must be given its final disposition. It is not something to abandon lightly.

Fig. 1. San Antonio night skyline as seen from north overlooking proposed interstate highway as it approaches city.

Postwar Arterial Highways For San Antonio, Tex.

***Contents in Brief**—Since traffic counts show that nine-tenths of the users of the highways to San Antonio, Tex., stop in the city, trade and traffic can be served best by arterial roads quartering the city and intersecting near its trade center. After a study of regional and local problems, east-west and north-south four-lane, limited-access highways, costing $21,000,000 were proposed to provide urban links for the proposed National System of Interstate Highways serving the city. Scenic features were taken into consideration in determining the route for the proposed arterials.*

ARTERIAL ROADS running east-west and north-south across the city are proposed for postwar construction as the link in the National System of Interstate Highways serving the metropolitan area of San Antonio, Tex. General location and structural details of the two roads are given by consultants, The Baker Engineers, Rochester, Pa., in a comprehensive report published by the Texas State Highway Department.

Decision on two roads quartering the city and intersecting near its business district was influenced by traffic surveys which indicated that 85 percent of the traffic entering the city departed by the same or an adjacent local route. Crossing arterial roads centering in the business district would then best serve regional traffic, would considerably relieve business street congestion by arriving and departing regional traffic, and would add little if any non-stop through traffic to business streets. No by-pass or belt-road location offered equal advantages.

Many factors considered

Decision on location and type of arterial roads was based on a comprehensive survey and analysis of influencing factors. These included studies of regional production and trade, local markets, railway service, local industries, airports, business and residential zoning, scenic and recreational possibilities, right-of-way advantages, existing and prospective traffic, cost and many other conditions influencing engineering judgment. Only leading conclusions of these studies can be given in article space, but they extended far into the details of regional and city business and social life.

San Antonio, in Bexar County, southeastern Texas, is the central market of a trade area of about 50,000 sq. mi., bounded by the Rio Grande, the Gulf of Mexico, the Colorado River of Texas and a meridian about 125 mi. west. Austin, the state capital, is about 75 mi. northeast on the Colorado River. The products of this trade area are largely extracting —fruits, vegetables, cotton, and petroleum and their processed forms. Livestock, steers, calves and hogs, wool and mohair are also important trade items. These products come to the city by train and trucks; a small volume is processed there, and the re-

ainder are consumed locally or are ipped by rail to northern and west- n markets or to Gulf ports for South merica or for eastern and southern ates' consumption or processing.

Of the total buying income of the ity and its trade area, it is estimated at only 37 percent originates in the etropolitan area or about $225,- 00,000 of a total of over $600,000,- 00. Of the 37 percent of city origin, 0 percent comes from military es- blishments—Fort Sam Houston and elley, Randolph, Brooks and smaller irfields. Equally notable is the fact at only 7 percent of the total (100 ercent) income is derived from anufacturing and processing in the etropolitan area and only 5 percent om similar activities in the trade rea outside.

It is estimated that the over-all ex- loitation of resources in the trade rea has amounted to only about 25 ercent of its potentialities. To en- ourage development of the potenti- lities and to capitalize on them for s benefit is the opportunity of San ntonio. The means lie in progres- ive development of transportation acilities and particularly trade-area- o-city highway facilities. Specifi- ally, the immediate need is arterial ighways into and through the metro- olitan area.

Fig. 2. Four-lane, limited-access arterial roads quartering the city are proposed to link up the interregional highways serving San Antonio, Texas.

Transport and traffic

Three major railways serve the city nd trade area. The routing into and hrough the city is shown by Fig. 2. hese railways serve, in addition to heir own terminal yards, 367 indus- rial sidings and 40 train tracks. Two f the railroads provide intracity reight service by trucks.

Public service transport by high- way is afforded by 27 motor freight carriers and 25 passenger bus-line op- erators. Both provide local and long- distance transport. The motor freight carriers run regularly scheduled trips between San Antonio and seven dis- tant major Texas cities. They provide for shippers' service some 200 four- and six-wheel trucks and 250 tractors with box trailers, special trailers, or refrigerator trailers. Passenger serv- ice is furnished the city directly by seven national and regional bus com- panies and indirectly by 19 others which operate within the surrounding trade area.

Four commercial airlines now pro- vide San Antonio with war-restricted service but plans are in mind for a major extension of postwar airline service.

The main road pattern of the trade area is radial, with San Antonio the

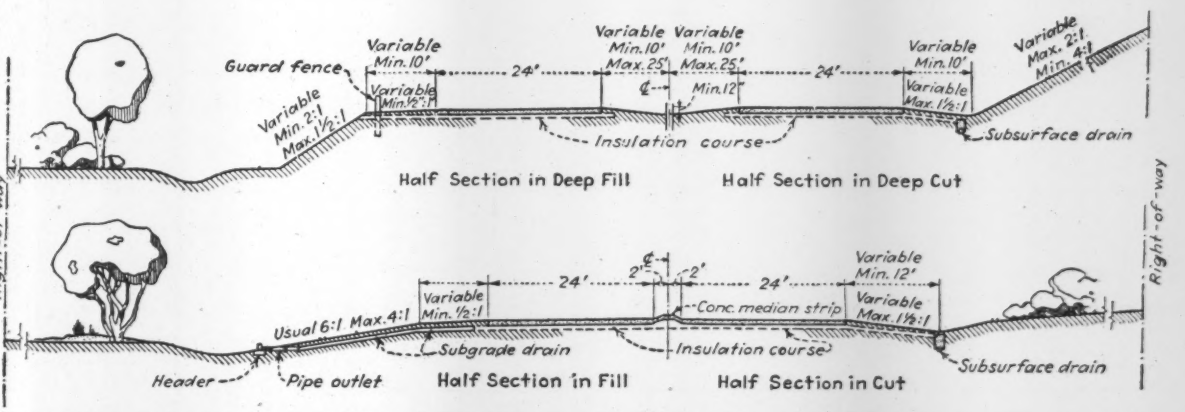


Fig. 3. Sections of proposed San Antonio arterial highways showing allowable variations in dimensions and structure.

hub; intersecting roads out through the area connect the radials making a rough checkerboard of state and federal highways. The ten radial roads into San Antonio are quite evenly spaced around the circle as indicated by Fig. 2 and 4. Three traffic counts were made: (1) to determine origin and destination, (2) to determine classification and (3) to determine intra-city routine pattern. The short-time counts were adjusted to represent annual daily average traffic and were expanded for a ten-year growth.

The origin and destination count disclosed that 60 percent of the traffic entering the city departed by the same route. Of the 40 percent entering and departing by different routes the predominating flow is (Fig. 2 and 4) to and from: U.S. 90 east and U.S. 90 west; U.S. 81 north and U.S. 81 south; U.S. 81 north and U.S. 90 east; U.S. 81 north and U.S. 90 west and U.S. 87 north and U.S. 90 west. As particularized, the north-south and east-west trend of traffic flow and the predominating east-west trend are indicated. Of all traffic entering the city the count indicated that 85 percent stopped and only 15 percent was non-stop through traffic. The classification count indicated only 9½-percent truck traffic. Results of the intra-city traffic-volume survey is given graphically in Fig. 4. This flow map conforms closely to the indications of the origin and destination count.

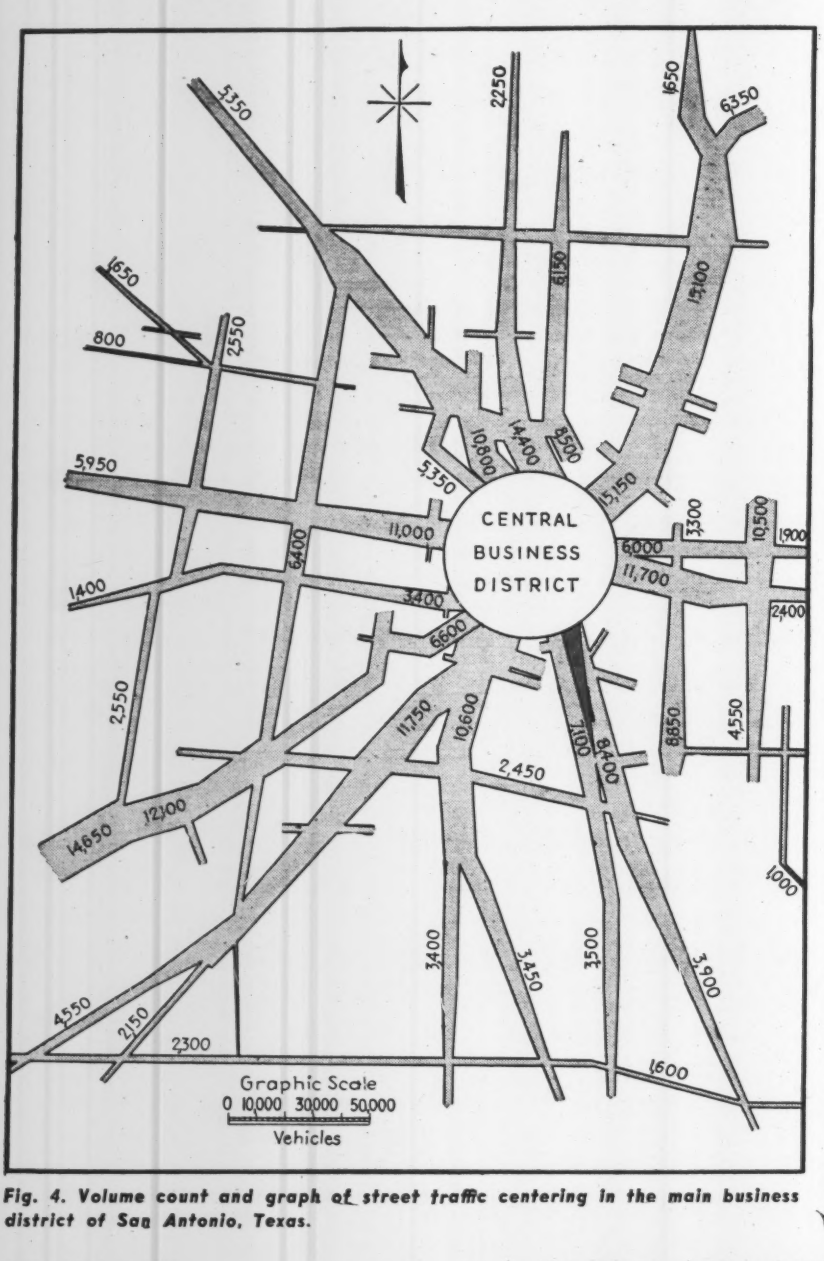


Fig. 4. Volume count and graph of street traffic centering in the main business district of San Antonio, Texas.

Arterial highway plan

The roads of the National System of Interstate Highways designated to serve San Antonio, Tex., were U.S. 81, U.S. 87, and U.S. 90, in Fig. 2. It seemed certain that the present locations through the city could not be adapted to urban interregional highway requirements for width, alignment, limited access and other qualities of structure. Property damages would be prohibitive even if existing streets could be made to conform or were well located for future community and traffic development. Similarly, an outer-belt road connecting the interregional and the outer radial roads entering the city was discarded since nine-tenths of the traffic wishes to enter the city and not to by-pass it.

The remaining solution was separate arterial roads through the city and this was also the logical solution. Such a plan provided locations outside and within the city that would permit the required type of structure; would require least dislocation of existing street pattern; would best serve business, industrial and transport interests; would involve the least property damage and would increase the scenic qualities. The selection was a north-south and an east-west arterial, Fig. 2, interconnecting the three interregional routes (U.S. 81, 87 and 90) and intersecting just north and east of the business district of the city. Alternate Line B from a part of the north-south artery is offered for consideration as being less costly than Line A. The north-south road on Line A is 16.95 mi. long. The length of the east-west line is 14.47 mi., and the combined length of both roads is 31.42 mi.

Design standards and cost

Complete location plans are presented in the consulting engineers' report with the proviso that changes in detail will follow with final working plans and particularly in developing traffic interchange plans, as shown by Fig. 5. A four-lane divided highway is planned; it is designed for speeds of 75 mph. in rural sections, 60 mph. in urban sections and reduced rates on interchange ramps

and curves. Maximum curve is 3½ deg. on the east-west line and 4 deg. on the north-south line. The maximum grade on any line is 5 percent and this only in one place. On urban sections and flat-rural terrain, grades need not exceed 3 percent.

In general, the recommended road width is 88 ft. divided as shown by Fig. 3. A reduction in width to 72 ft. is planned in the city where established street rights-of-way or important bordering structures make narrowing economically important. By reducing the width of the median strip this narrowing will not reduce traffic widths. Incidentally, a change in median strip width from time to time is contemplated to prevent the monotony of continuously parallel roadways. For the same reason change in grades and alignment are proposed.

Generally the road is on the surface; intersecting roads underpass, or service roads or traffic interchange structures are provided. A strictly limited-access structure is contemplated; traffic will enter and leave the road only at the selected interchange points indicated by black circles in Fig. 2. A plan of the interchange where the two arterials intersect is shown by Fig. 5. The others are generally more simple.

In general, while practicalities of trade and transport have been kept as controlling requirements of location and design, it has not been overlooked that San Antonio holds a high place in the history of Texas liberties. Scenic features are given all practicable attention principally by variety in line and grade, or by a location near parks or places of historic and recreational interest, or to present broad city views as shown by Fig. 1.

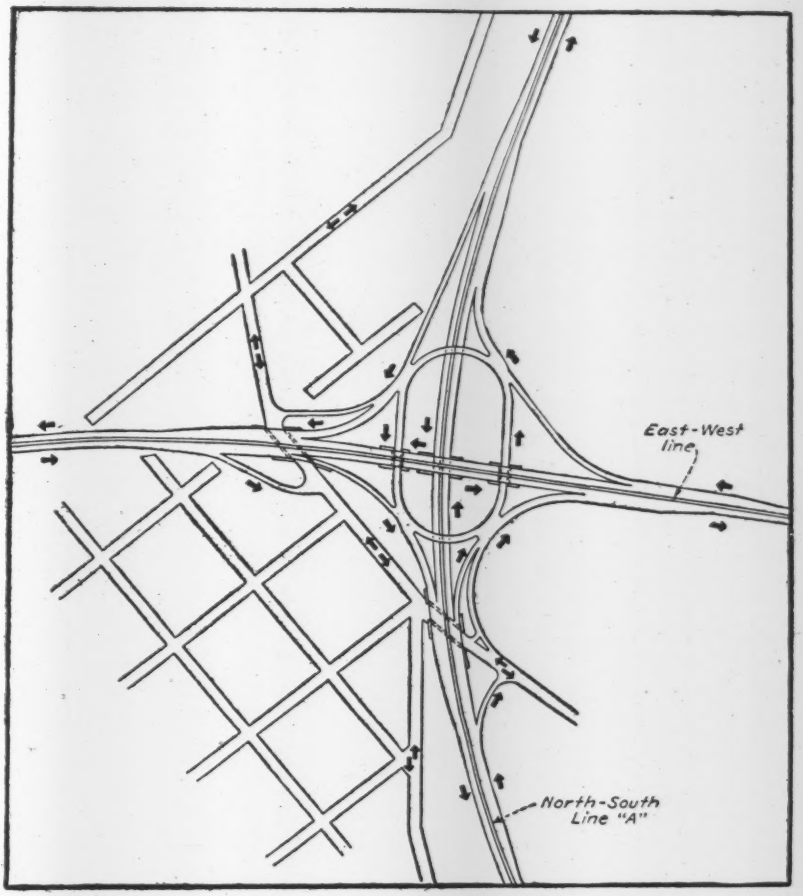


Fig. 5. Tentative plan of structure for traffic interchange between east-west interregional and north-south Line A of the San Antonio arterial highways.

Estimated cost

Based on a total length of 31.42 mi. if north-south Line A is adopted, the estimated cost is $21,054,532 or about $670,000 a mile. The grand total includes $14,974,157 for construction; $2,319,000 for interchanges, and $3,761,375 for land damages.

This article is prepared from a report by Michael Baker, Jr., The Baker Engineers, Rochester, Pa., published by the Texas Highway Department, D. C. Greer, State Highway Engineer.

Sewerage Systems Financed By Service Charges

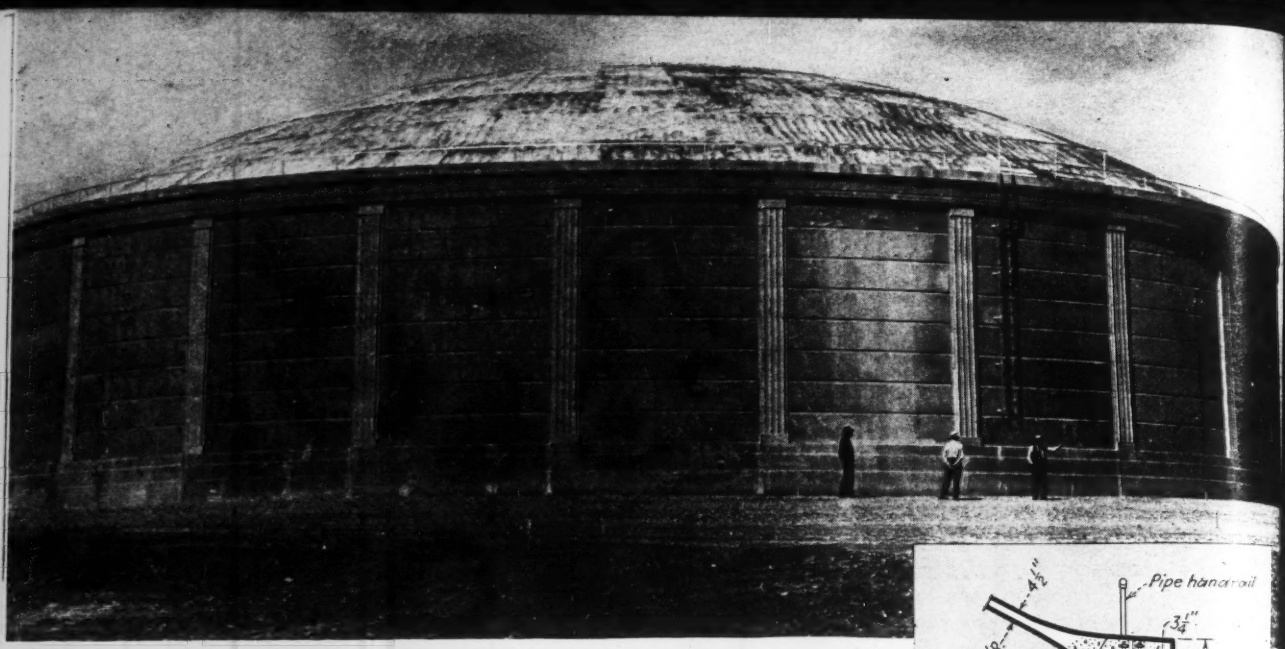
Four Virginia cities—Fredericksburg, Radford, Richmond and Williamsburg—are financing the construction or operation of their sewerage systems through collection of service charges.

Service charges in Fredericksburg are $2 a year per house or connection, according to data supplied to the American Public Works Association, and sewer construction has been paid for out of the general treasury for many years. No city bonds for sewers have been issued since 1901.

Radford levies sewer rental charges on a scale graduating from 50 c. a month per connection for 10,000 gal. of water or less up to $2 monthly for 150,000 gal. or more. In addition, a charge of $10 is made for each connection. Sewer rentals are collected by including charges on the monthly water bill.

Rental charges in Richmond are based on a levy of 10 c. per linear foot of property front per year. In Williamsburg, the charge is $1 per connection per quarter.

Sewer rental charges generally are levied in lieu of all other charges or levies for sewers and sewerage purposes. They are imposed on users outside the corporate limits by four other cities—Charlottesville, Danville, Harrisonburg and Portsmouth. Norfolk has no system of rental charges at this time, but is considering adopting a rental plan if and when new sewage treatment plants are built.



Two-Way Prestressed Concrete Water Storage Tank

J. Roland Carr
Associate Editor, Engineering News-Record

***Contents in Brief**—New concepts in the design and construction of large reinforced concrete water tanks were applied to a 4¾ mg. circular reservoir completed recently at Great Falls, Mont. In addition to the customary horizontal bands of prestressed hoops, this tank employs vertical prestressed steel rods to guard against horizontal cracks from temperature differentials and plastic flow of concrete.*

CONSIDERABLE theoretical analysis and a large amount of faith in prestressed concrete tank construction were incorporated in a recently completed 4,750,000-gal. water tank at Great Falls, Mont. That the analysis was correct and the faith justified was evidenced when the tank was tested to full capacity and no leaks appeared, even before applying a coating of asphaltic waterproofing on the floor and inside face of wall. Some small sweat spots appeared at the form ties but they sealed themselves within 24 hours.

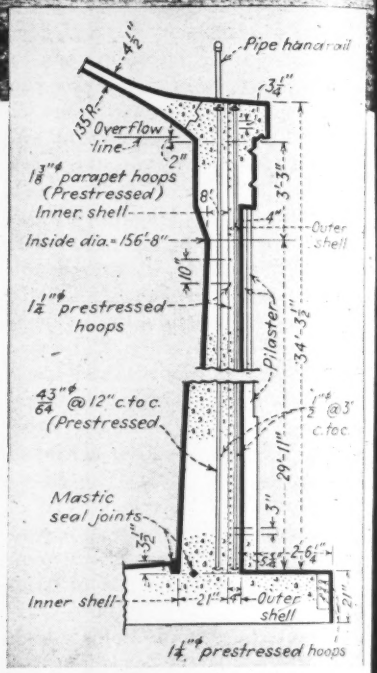
What made the prestressing of concrete in this particular water tank of paramount importance was its immense size. The tank has an average inside diameter of 156 ft. and an average water depth when full of 33 ft. 3 in. It is built above ground and carries a thin-shell concrete dome rising 24 ft. 9 in. above the walls.

Prestressed concrete tanks for the storage of water and liquid fuels have been built for more than ten years. But few, if any, have been designed for such a capacity as this one. Water tanks up to 3-mg. capacity were built a few years ago in California (*ENR* Mar. 13, 1941, vol. p. 419), and the U. S. Navy has built several 250,000-gal. prestressed concrete tanks for the storage of liquid fuels (*ENR* Jan. 28, 1943, vol. p. 135). Methods employed in the construction of these, as well as for a recently completed 300,000-gal. water tank in San Francisco (*ENR* May 3, 1945, vol. p. 636) were similar to those employed at Great Falls, except for the manner of prestressing the concrete.

Two sets of vertical rods

Several new features were introduced in prestressing the circumferential steel rods, or hoops, ordinarily employed in such structures. An added precaution against the formation of horizontal cracks was the introduction of prestressed steel rods placed vertically throughout the entire wall. Two such sets of rods were employed—one placed 4 in. inside, and the other 1 in. outside, of the main circumferential prestressed hoops. These vertical rods were 43/64-in. dia., spaced 12 in. apart in the inner set and 24 in. in the outer set.

Prestressed vertical steel was used in the design of the wall because experience had shown that horizontal



Two rows of vertical prestressed rods prevent horizontal cracks in the wall, while a beveled keyway at parapet permits joint rotation under temperature changes in the thin reinforced concrete dome.

cks often develop in a concrete k of this type. It is difficult to ow just how such walls, supporting oncrete dome, can get in tension tically—it may be caused by un- al shrinkage of concrete during ring, non-uniform layers of con- te, or uneven thermal expansion. ertheless, the designers believed sufficient prestress in vertical pression on the concrete would minate such trouble. Theoretically, vertical prestress varied from 120 on the thinnest section of wall to psi. at the thickest base section.

n accordance with the usual pro- ure in such construction the cir- r wall, which measures 34 ft. 3½ from the top of parapet to base of l, was constructed in two units. first includes the main wall, 8 in. k at the top with a sloping interior to provide a 21-in. thickness at bottom. Preliminary designs con- plated stepping the inside face of wall as necessary to provide the uired thickness, but that idea was ndoned in favor of the sloping face which needed less form con- ction. The outside face is vertical. s main wall contains the inner row vertical prestressed bars and und it are the main horizontal ds, or hoops.

he second wall unit, or outer shell, vides a covering for the hoops and ishes the architectural treatment the tank by a series of pilasters. as built to a minimum thickness in. at the top and stepped out at pilasters to a total thickness of in. This, then, provides a completed wall 12 in. thick at the top and 2 ft. 6¾-in. maximum thickness at the base. Both the main wall and the outer shell were poured in 26 vertical sections, each about 19 ft. wide.

Prestressing the vertical rods

Considerable attention was given to prestressing the 43/64-in. vertical rods since they would be entirely surrounded with concrete at the time of inducing stress, thus making it impossible to insure uniform stress throughout their entire 34-ft. 1-in. length by pounding them with a small sledge, as is customary for exposed rods in such construction.

One of the chief requirements was that no vertical rod should become bonded to the surrounding concrete. Accordingly, each was thoroughly greased for its entire length and spirally wrapped with a tough grade of building paper prior to installation.

A test was made on the effectiveness of this method of preventing bond between concrete and steel by preforming a 6-in. high recess in the concrete around the bolt head and washer welded at the bottom of one of the vertical rods. After the main wall had been poured this rod was easily raised the full depth of the recess, proving the absence of any bond.

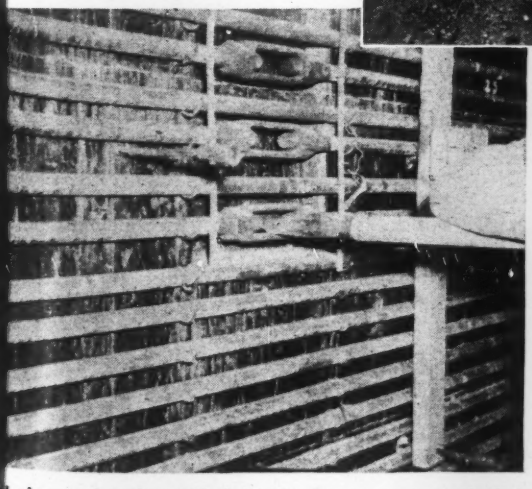
To prevent bending in the vertical rods due to their weight and length they were hung from outriggers spiked to the top of the timber forms. They cleared the concrete floor of the tank by 1½ in. Also, the nut and the 2½-in. washer at the top of each bar were countersunk below the top of wall for appearances.

Recesses formed with paper cups

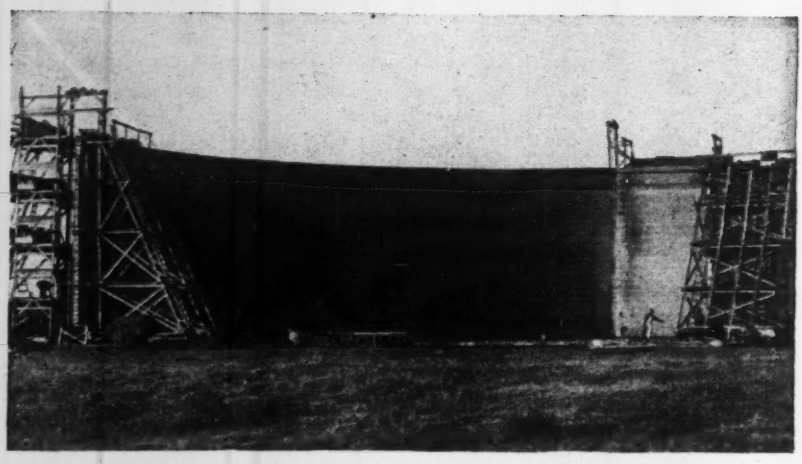
The contractor used a simple and inexpensive device to form the 1¾-in. deep recesses required for the top nut and washer. It consisted of a 3-in. dia. waxed paper cup, with a hole punched in the bottom to permit its being slipped onto the threaded end of the rod, with the top of cup coinciding with the top of wall. The washer and nut then were screwed onto the rod with the washer bearing on the bottom of the cup.

Each cup was filled with ordinary building plaster to prevent its collapsing when concrete was placed around it. Removal of the plaster after the concrete wall had been poured, exposed the nut and washer in the 1¾-in. deep circular recess. After the vertical rods had been prestressed the recesses were filled with concrete.

Turnbuckles shown below, were tightened with these two types of wrenches.



pieces of rods welded to the hoops prevented their rotation during tightening operations. Right: Bar stress was rolled by a job-made extensometer operating in two control points punched 4 ft. apart.



Two sets of movable forms were used progressively around the wall to form the interior surface (at top), while the dome was supported on laminated timber beams (at bottom) carried on wooden posts resting on the concrete base.

The actual prestressing of the vertical rods was simple. Each rod in the inner wall was brought up to its full design stress of 32,000 psi. by first screwing down the nut at the top of the rod to a snug bearing on the washer, taking a zero reading with an ordinary micrometer depth gage, then continuously tightening the nut until the elongation of the rod as measured by the gage, indicated the desired stress had been reached. Vertical rods in the outer shell were stressed to 15,000 psi. by the same method.

Due to the vertical rods being embedded in the concrete, there was no opportunity to measure their stresses accurately with an extensometer, nor was it possible to recheck them after they had once been tightened, other than to slack off the nut and start over again.

Prestressing the 81 horizontal hoops encircling the main wall was a more laborious and painstaking job. Each hoop was made of 13 rods, 37 ft. 10½ in. long and joined together with turnbuckles. Two sizes of rods were used; 1⅜-in. dia. spaced from 3 in. to 5 in. in the lower half of the wall and 1¼-in. spaced from 5 in. to 10 in. apart above.

Rods were not upset at their ends but had cold rolled threads to provide a tensile strength equal to that in the main body of the rod. Turnbuckles and rods had right and left hand threads to permit adjustment.

Size and spacing of the hoops were based on using a uniform prestress of 32,000 psi., while the inner wall was beveled to provide an approximately uniform concrete stress at various water depths. Of the total stress induced in the hoops, 21,000 psi. is required to balance the stress due to water pressure when the tank is full, while the remaining 11,000 psi. allows for negative shrinkage and plastic flow of concrete, positive temperature, and possible earthquake stresses, plus an ample factor of safety. The hoops had a tested yield point of 50,000 psi.

After the inner wall was poured and cured, the hoops were appl and tightened, placing the concrete compression of approximately 1 psi., and allowed to set for 20 da The concrete, in which one pound admixture per sack of cement used, for greater workability a durability, had a tested compress strength exceeding 5,000 psi. at days.

At the end of the 20-day period hoops had lost some of their str indicating that considerable shri age and plastic flow had taken pl in the concrete. It was believed the designers that this represented major part of all that would ever t place, because filling the tank w water should eliminate further shri age and would reduce the conc compression stress to a point wh further plastic flow should be v small. The hoops were then retig ened to 32,000 psi. and pouring the outer shell proceeded.

On filling the tank, the c and steel, assumed to be acting gether in the ratio of 1 to 10, took stress, the concrete losing 750 psi compression, the steel gaining 7, psi. in tension. A slight further of prestress in the hoops can be pected, but from a final analysis all the known and assumed fac the designers are confident that s cient compression will always rem in the concrete, computed to b minimum of 50 psi., to prevent possibility of cracks and leaks.

Hoops in banks of eight

The horizontal hoops for prest ing the concrete wall were insta and tightened in banks of eight. T were held in correct position by nails inserted in holes drilled thro the outer forms and left embedde the concrete.

To keep the hoops from twi when tightening the turnbuc short pieces of ½-in. reinforcing were placed vertically on each si a bank of turnbuckles and welded to the rods. Occasiona weld would break loose during t ening, in which case the turnb was slacked off, a new weld m and the hoop retightened.

Turnbuckles operated in be recesses 24 in. long, 15 in. wide 2 in. deep, formed in the outer fa the concrete wall. They were gered alternately one-half the l of the individual prestressed ro

ut 9½ ft. This resulted in four al-ate turnbuckles in each bank of nt being in the same vertical plane. to slow delivery of the prestress-steel, some two months elapsed ween pouring the wall and erection he hoops.

tresses induced in the hoops were trolled at all times by extenso-er readings using an Ames dial duated to 1/1,000-in. elongation, ch was equivalent to 625 psi. ss in the rods. All readings were n with the extensometer operating o control points punched exactly apart in the hoops prior to their al stressing.

Job-made extensometer

he extensometer was a job-made aratus, yet it functioned extremely It was made out of two pieces -in. rod about 21 in. long with lengths of ¾-in. square rods to one end of each pipe, be-which was mounted the Ames The outer end of each length of carried a tapered pin, which op-d in the previously punched con-points in the hoops. A small strap saddle, welded to the two near their inner ends and fitted adjustable screws on each side, her with the tapered pin at the end provided a three-point sup-for each half of the extensometer. e 4-ft. length of extensometer adopted for measuring elonga-of the prestressed rods instead of the 8-in. length ordinarily used in such work since it was believed to give a more representative measurement. Extensometer measurements were made midway between turnbuckles for the same reason.

Three sets of punch marks for extensometer control points were made in each of the 81 hoops encircling the tank. They were located at the one-third points and painted yellow for easy identification. Furthermore, the different banks of control points were numbered, and an elaborate record of gage readings was kept of each set of control points from the time of zero stress in a rod until it had reached its final theoretical stress. Punch marks were made with a steel rod templet fitted with small removable steel points. In fact, the punching points and tapered pins in the extensometer were made interchangeable to insure accuracy of the measurements.

Never-ending job of tightening

Prestressing of the concrete wall started at the bottom and progressed upwards. It seemed to be a never-ending process of tightening and re-tightening the 1,053 turnbuckles until final stresses were reached. All tightening was done by three 2-man crews. They started at the one-third points of the tank's circumference and worked clockwise with each gang covering one-third of the periphery of the tank.

All eight hoops in any one bank were tightened in one trip around the tank, by first tightening the four turnbuckles at the starting point, then moving on to the next four turnbuckles which engaged the four alternate hoops in that bank.

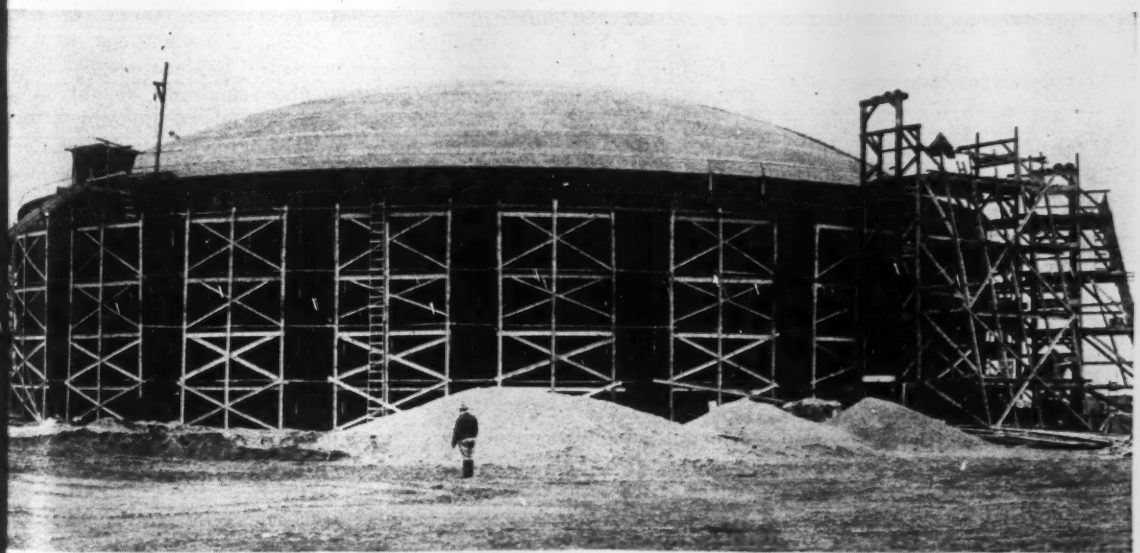
Spot checks on initial stressing

First operation in prestressing any bank of hoops was to mount them in correct position around the tank and tighten all turnbuckles to a snug but non-stressing pull. Punch marks then were made with the 4-ft. long templet, and a zero stress reading made with the dial gage. Turnbuckles were given a one-half turn and spot check readings made (about one reading per bank at three different points around the tank) to insure that the rods were taking initial stress.

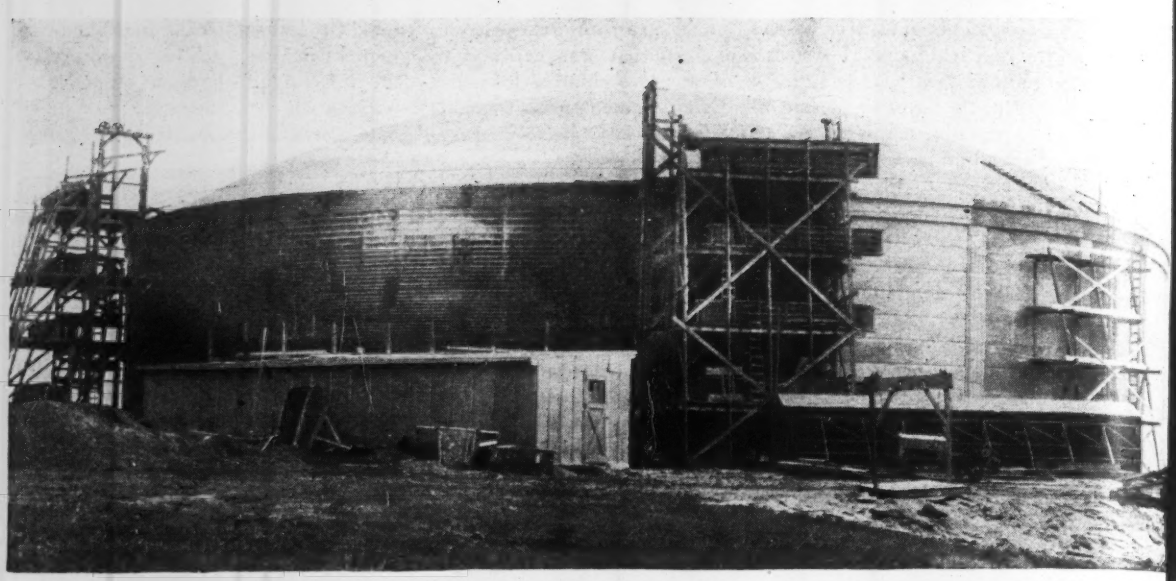
Throughout the entire operations, rods being stressed were hammered continually between turnbuckles to insure a uniform flow of stress. A 4-lb. sledge was used, with one free-arm blow being applied at about 1-ft. intervals.

Although particular care was taken to see that the rods were hammered sufficiently, it was one operation which the workmen were prone to slight; chiefly because they failed to understand the theory involved.

After initial stresses had been induced in the bottom bank of hoops, the workmen moved up to the second bank, repeating their operations and continuing on to the top of the main wall. Spot check readings were taken



me framing was removed through a hatch provided in the roof and chuted to the ground. Turnbuckles on the pre-d rods were tightened from a working scaffold which completely encircled the tank.



Movable scaffolds originally employed in pouring the main wall were used to place the outer shell covering of the pr stressed hoops. Concrete pours were made in 3-ft. continuous lifts.

until each hoop was stressed to about 25,000 psi. Above 25,000 psi. the stress built up rapidly, necessitating continuous readings on each hoop as it was stressed on up to 32,000 psi.

The nearer the full stress in a hoop was approached, the smaller was the increment of turn of the turnbuckles. This was reduced to a one-sixteenth turn near the end. Occasionally the extensometer readings would get way out of line, for some unknown reason, in comparison with those adjacent to it. In such cases turnbuckles were slacked off, a zero stress reading was made, and the rod retightened to conform to the stress in those on either side of it.

Ten cycles of tightening

Some idea of the magnitude of work involved can be gained from the fact that there were ten complete cycles of turnbuckle tightening (from bottom to top) with adjustments being made on each of the 1,053 turnbuckles involved during each trip. In addition, there was the stressing of ten hoops in the parapet of the wall and three around the periphery of the base of the tank.

The three 1¼-in. bars placed around the circular base of the tank were stressed to 32,000 psi. as an added precaution to keep the construction joints in the slab closed. Incidentally, due to its large area, the base was poured in seven segments with keyed and caulked vertical joints formed between each of the adjacent pours.

Stressing the ten 1⅜-in. hoops in the wall parapet followed a different pattern than that employed in the main wall. Two requirements were involved. One was to partially prestress the parapet to insure firm contact between it and the thin reinforced concrete dome as the latter was poured. The other was to fully prestress the parapet, after the dome had been poured and cured, and before removal of the supporting forms, to prevent undue settlement of the dome at the crown. Had this settlement occurred, the dead load thrust line might have moved outside of the dome roof section causing it to collapse.

To fulfill these two requirements, the ten parapet hoops were stressed to 10,000 psi. prior to pouring the dome. After the dome had been poured and properly cured, the parapet bars were brought up to their full 32,000-psi. stress. Results were even better than anticipated—upon removal of its timber supports, the dome settled only ⅛ in. at its center. This was remarkable considering the span (156 ft.) and minimum thickness (3½ in.). Moreover, this final stressing of the parapet hoops evidently lifted the dome nearly off its supports, greatly facilitating the removal of the supporting wedges.

Although the chief intent of this article is to describe the methods employed in prestressing the concrete wall, both vertically and horizontally, certain other features of the tank construction deserve brief mention.

Preparation of foundation

Preparation of the foundation f the tank was a job in itself. The ta is located on a hill covered with abo 7 ft. of blow sand underlaid with firm gumbo often found in that pa of Montana. It was necessary to r move the entire 7 ft. of blow sand a replace it with a well compacte gravel, not so much to provide i creased bearing for the tank but guard against unequal settlement. T maximum design bearing pressu did not exceed 2,000 lb. per sq. ft.

Special precautions also we necessary to insure the underlyi gumbo remaining dry at all tim since it swells considerably when w Accordingly, a network of clay drains were installed in concr paved gutters placed beneath t gravel fill and the entire area of posed gumbo covered with an phaltic membrane coating prior placing the gravel backfill.

The base of the tank is reinfor concrete, 9 in. thick over the cen two-thirds and stepped down to 21 under the wall. Two mastic s joints were installed between wall a base; one around the interior surf of the wall for expansion and c traction of the tank, and the o directly beneath the wall to serve a secondary seal should the o spring a leak.

Also worthy of mention is the manner in which the wall was constructed. No horizontal construction joints were permitted. Instead, the wall was poured in 26 monoliths, each about 5 ft. wide and extending from the base slab to top of parapet. Beveled keyways were formed vertically between monoliths to lock them together.

In spite of the unusual height of wall (34 ft. 3½ in.) its form construction presented no unusual problems. Lumber forms were used throughout. The inner form was constructed as a movable scaffold, conforming to the inner surface of an entire monolith and reused for pouring 13 monoliths. Two sets of inner forms were used. After a monolith was poured the form was skidded into place for making the next pour.

A movable working scaffold was employed to erect the outer forms which were held in place with ordinary tie rods through the wall. This scaffold was equipped with a platform every 8 ft. and a hoist to raise the concrete into place. Concrete hours were made in 3-ft. continuous lifts from the bottom of wall to the top of parapet.

As would be expected in a structure of this size, forming the dome was a laborious task. Having no interior concrete columns, the dome had to be supported from the base slab on timber posts securely cross-braced in both directions and carrying curved, laminated girders and joists, which in turn supported the sheeting on which the thin dome was placed.

No top form for dome

No top forms were used in pouring the dome, which was placed in six circumferential ring pours, and vibrated. A beveled hinged joint was formed between the parapet and dome to permit free rotation of the joint as the dome rises and falls under temperature changes. This reinforced concrete dome is unusually thin for its span; measuring 4½ in. thick at the parapet and tapering uniformly to 3 in. at the crown. In view of its large diameter (156 ft.) and unusual height (61 ft. from top of dome to base) it is no wonder that some 80,000 b.ft. of lumber was required for dome forms.

Incidentally, all framing for the dome had to be removed through a small hatch provided just above the parapet. Forms above the parapet line were passed horizontally to the hatch and chuted down to the ground, but all supporting posts and bracing had to be raised by block and tackle and passed out through the hatch.

Total contract cost of the project is $254,000. The tank cost $154,000 and $100,000 was spent for the installation of some 12,000 lin. ft. of distribution mains. Nearly two-thirds of the funds were supplied by the Federal Works Agency. Justification for the project was founded on additional requirements of two large U. S. Army air bases established nearby and nearly a 40-percent population increase in Great Falls over the past five years.

Corwin & Co., Inc., consulting engineers, Great Falls, prepared the designs and supervised construction of the project. Personnel on the work included M. E. Chamberlin, chief engineer; C. A. Hunter, chief architect; W. J. Wenzel, assistant chief engineer; Clarence Nelson, chief draftsman; W. A. Wise, chief structural engineer; and C. A. Decker, assistant chief engineer for construction.

Dudley-Anderson & Co. of Great Falls were the contractors on the water tank and the Blakeslee Construction Co., Great Falls, held contracts for installation of the water mains and distribution system. Fred Dudley designed the tank forms and supervised construction methods.

Wm. H. Wick was the FWA construction engineer, reporting to Fred T. Evans, district engineer, Seattle, Wash.

Charges for Outside Sewerage Service Show Wide Variation

Most larger cities charge neighboring communities for providing them with sewerage service. Designed to meet the cost of service, such charges usually take into account the original investment in intercepting sewers and treatment works as well as maintenance and operation costs, according to the International City Managers Association.

A variety of methods is used for determining outside sewerage charges. A number of cities, including Akron, Baltimore, Buffalo, Los Angeles and Philadelphia, base their charges on amount of sewage flow into their respective sewerage systems. This is determined by meters at the point of delivery and at the entrance to the treatment plant.

Other cities base charges on the amount of water used. Morristown, N. J., charges a fixed percentage of the water bill. East Cleveland and Cleveland Heights pay Cleveland 34c. per 1,000 cu. ft. of water.

Another method is for a city to charge on the percentage of the contributing area to the total area served by the sewage disposal plant. Rochester, N. Y., uses this system for some suburbs while charging other suburbs from 8 to 10c. per foot of sanitary sewer in use. Lucas County, O., contributes to the cost of Toledo's pumping station and sewer construction costs on an area basis; the county also pays charges for all new connections, and pays other charges.

A connection charge may be based upon the proportion of the population within each unit as related to the total population served by the sewerage system, with costs recalculated every 10 years on the basis of changing census figures. This type of annual charge is made in St. Louis, where satellite municipalities also are assessed connection charges which take into account construction and maintenance costs. Outside communities also contribute to the reconstruction of any sewer to which they make connection and share in construction of any treatment and pumping plants that St. Louis may be required to provide.

Other provisions sometimes included in contracts for sewer service cover such matters as renewal; the exclusion of storm water from the sewerage system; approval of plans and standards of construction; inspection of facilities; maintenance of certain records; and prohibiting the municipality receiving sewerage service from allowing another city to connect with its sewers.

Failure to pay for sewerage service provided is frequently specified as sufficient cause for termination of a contract.

Runoff from Water-Sealed Soil

L. A. Westby and L. L. Harold

Former Acting Project Supervisor, Blacklands Experimental Watershed, Waco, Tex., and Project Supervisor, North Appalachian Experimental Watershed, Coshockton, O., respectively.

***Contents in Brief**—Three storms in three days early in 1944 occurring near Waco, Tex., where the clay soils swell and become sealed when subjected to considerable rain, caused floods, when 13 to 14 in. of rain fell. Peak run-off rates were about 0.6 to 0.7 in. per hr. less than the maximum 20 min. rainfall intensities, which varied up to almost 5.5 in. per hr.*

A NOTABLE HIGH RATIO of runoff to rainfall due to three successive storms within three days occurred near Waco, Tex., early in 1944. Although this runoff caused floods and damaged farmland by erosion, the purpose of this account of the storm is to set down the figures of rainfall and runoff as recorded by the U. S. Soil Conservation Service Blacklands Experimental Watershed, near Waco, and to present some indicative conclusions. To conserve space, details are given for only one of the three 300-acre watersheds included in the study, but they are typical.

If further records are desired they can be obtained by writing M. L. Nichols, chief of research, Soil Conservation Service, Washington 25, D. C. Also a detailed description of the Blacklands Experimental Watersheds, including map, is given in Hydrologic Bulletin No. 5, 1942, U. S. Department of Agriculture.

The storm records

In the storm being considered, a total of 13 to 14 in. of rain fell between early afternoon of April 29 and noon of May 2, or virtually three days. The accompanying tables gives the storm figures for each day for watershed *W1* and also shows that during the three storm periods there were three periods of extraordinarily high rainfall rate, one on April 29 and two on May 1. The last storm of May 1 was the one of highest rate and the rainfall intensity-duration curve for this storm, Fig. 1, shows that the maximum rates for periods of one hour and less were of the order of a 10-year recurrence interval, according to Yarnell (Misc. Pub., 20 U.S.D.A.), whereas the maximum rate for 2-, 3- and 4-hour values approached a 100-year recurrence interval.

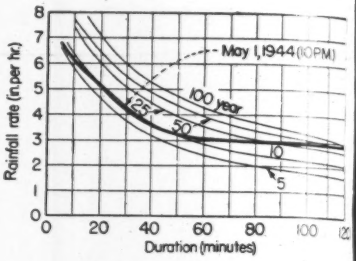


Fig. 1. Rainfall intensity-duration for the two highest storms (No. 6 and 7) of April 29—May 2, 1944, compared with Yarnell intensity-duration curves for various recurrence intervals.

PEAK RUNOFF AND CORRESPONDING MAXIMUM RAINFALL RATES IN IN. PER HR. AND RAINFALL AND RUNOFF AMOUNTS IN IN. FOR WATERSHED W1.

Storm No.	Date (1944)	Peak runoff rate	Maximum rainfall rate							Amount		Rainfall minus Runoff
			15 min.	20 min.	30 min.	1 hr.	2 hr.	3 hr.	4 hr.	Rainfall	Runoff	
1	April 29	0.83	4.5	4.0	3.1	1.6				1.65	0.26	1.39
2	April 29	1.24	2.2	1.9	1.5					1.21	0.55	0.66
3	April 29	1.16	1.6	1.4	1.1					0.82	0.77	0.05
								Total		3.68	1.58	2.10
4	April 30	1.72	2.7	2.6	2.0					1.55	1.16	0.39
5	April 30	1.68	2.3	2.0	1.6					1.16	0.99	0.17
								Total		2.71	2.15	0.56
6	May 1	3.54	4.6	4.3	4.0	3.1	2.9	2.1	1.7	6.45	6.23	0.22
7	May 1	4.51	5.5	5.3	4.2							
8	May 2	1.01	1.2	1.1	1.0					1.12	0.83	0.29
								Total		7.57	7.06	0.51
								Grand Total		13.96	10.79	3.17
	1940 Oct. 31		6.5	5.4	4.0							
	1941 June 10	4.07	5.6	5.0	4.0							

Note — Watershed *W1* for which rainfall and runoff are given above has an area of 176 acres, an average slope of 2.33 percent and the land use is cotton 36 percent, corn 19, oats 15, sorgum 8, and pasture meadow 22 percent. The other two watersheds are: *W2*, 130 acres, slope 2.45 percent, use cotton 38 percent, corn 20, oats 15, sorgum 2 and pasture-meadow 25 percent. *Y2*, 132 acres, slope 2.86 percent, use cotton 15 percent, corn 17, oats 24 and pasture-meadow 44 percent.

Moisture seals the soil

In the Blacklands, the heavy clay soils swell and become sealed when subjected to considerable rain. At very little water enters the soil after this swelling occurs, most of the rainfall following the April 29 storm contributed to the flood runoff. Data from the watershed listed in the table indicate that about 2 in. of the 3.5 in. rain of April 29 was absorbed by the clay soil, whereas less than 0.6 in. was absorbed from each of the 2.6-in. and 7.6-in. storms of April 30 and May 1-2. The graphs, Fig. 2, show rates and accumulated amounts of rainfall and runoff for the storm of May 1-2 for watershed *W1*. Graph

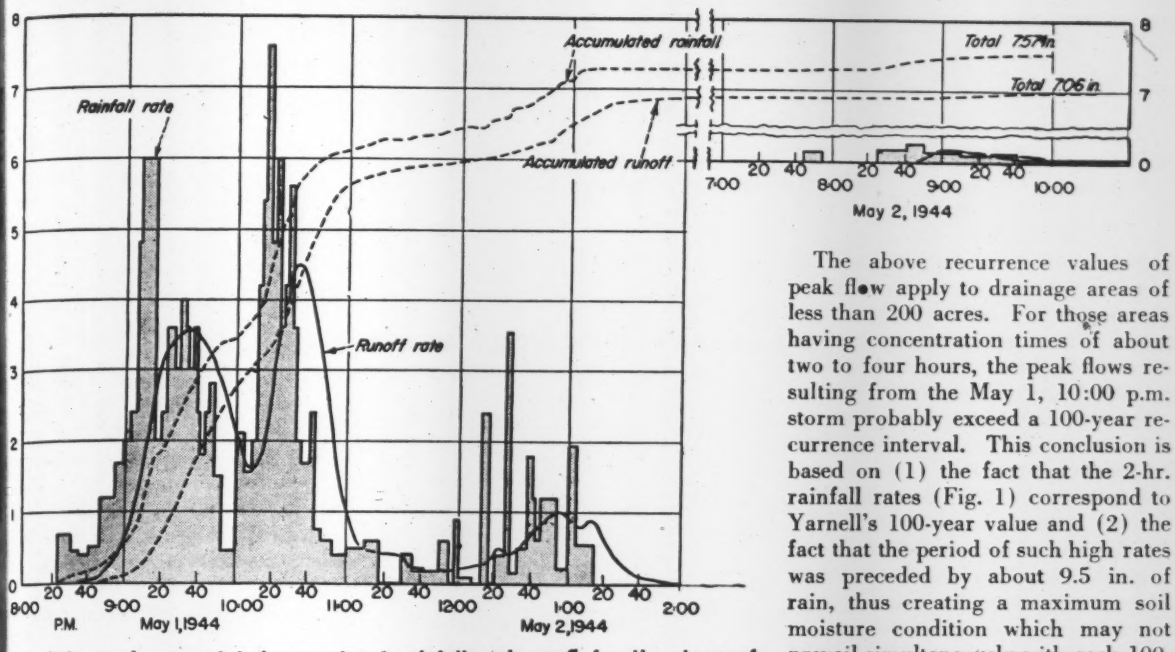


Fig. 2. Rates and accumulated amounts of rainfall and runoff for the storm of May 1-2, 1944, for watershed W1.

watersheds *W2* and *Y2* are simi-, as stated before, to those for tershed *W1*.

Analysis and conclusions

The fact that the infiltration rates duced to about 0.1 to 0.2 in. per for the April 30 storm and to s than 0.1 in. per hr. for the May storm, coupled with the fact that rainfall intensities were highest the end of the 3-day storm period, the reason the flood stages during s latter period were the highest for ny years.

During the 7-year record 1938-44, the highest rates of flow from three watersheds were those oc-rring about 10:30 p.m. of May 1, 44 (see table). The second high-peaks were those of the storm of ne 10, 1941, rainfall rates for ich are also listed in the table. ese rates as well as the 20- and -min. rainfall rates of May 1, cor-pond to the Yarnell 10-year re-rrence interval. Although rainfall ords indicate that the soil was wet fore both of these storms, there was re rainfall immediately preceding May 1, 1944, storm and the re-ting peak flows were, therefore, her. Soil moisture was about 1 below normal field capacity for adow and cultivated areas just be-re the June 10, 1941, storm. It was estimated that the recurrence interval of the June 10, 1941, peak flows was of the order of 25 years and, accordingly, runoff peaks for May 1 for watersheds up to 200 acres in size are estimated to be of the order of 50 years recurrence.

Rainfall rates for the Oct. 31, 1940, storm for 20 and 30 min. duration also correspond to Yarnell's 10-year values; but the resulting runoff rates are much less than those of the June 10 and May 1-2 storms because of the dry soil conditions in October of that year. Soil moisture deficiencies for meadow and cultivated areas were 9 and 5½ in., respectively, below normal field capacity just before the Oct. 31, 1940, storm.

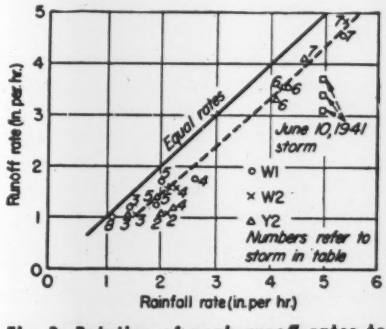


Fig. 3. Relation of peak runoff rates to average rainfall rates for maximum 20-min. storms (soil highly saturated) of April—May 2, 1944.

The above recurrence values of peak flow apply to drainage areas of less than 200 acres. For those areas having concentration times of about two to four hours, the peak flows resulting from the May 1, 10:00 p.m. storm probably exceed a 100-year recurrence interval. This conclusion is based on (1) the fact that the 2-hr. rainfall rates (Fig. 1) correspond to Yarnell's 100-year value and (2) the fact that the period of such high rates was preceded by about 9.5 in. of rain, thus creating a maximum soil moisture condition which may not prevail simultaneously with each 100-year rainfall rate. Unfortunately, records for the May 1 storm on the watersheds having concentration times of about two hours are not available for this vicinity as they were discontinued in July, 1943.

Eight peak runoff rates for watershed *W1* are given in the table, along with the maximum rainfall rates for 15-, 20-, and 30-min. periods closely preceding the time of the peak. A comparison of the peak runoff rates with the rainfall intensities for the various periods indicated that the 20-min. rainfall gave the most consistent results. The 15-min. intensities were too high and the 30-min. intensities were sometimes less than the runoff rates. The runoff peaks plotted against the corresponding maximum 20-min. rainfall intensity (Fig. 3) show a fair relation for the watershed. The peak runoff rates were about 0.6 to 0.7 in. per hr. less than the maximum rainfall intensities, a condition, of course, applying only for a highly saturated soil condition for the Blackland clays.

Authorize Slum Clearance

The Connecticut General Assembly has passed legislation authorizing the state's 169 cities and towns to appoint committees to make studies and recommendations for improvement of slums or unsightly areas, and development, including construction of housing facilities.

Waterworks Practice to Benefit from Application of Electronic Devices

A radical change in water filtration methods and practice resulting from the use of high frequency (or so-called supersonic) sound waves is envisioned by D. M. Nielsen, of the electronics division of the Foxboro Co. In a recent discussion before the New England Water Works Association, he saw the possibility of either the total elimination or else a great decrease in the size of sand filter beds as well as the application of electronic flocculation units through which the raw water would be processed at relatively high velocities of flow.

Direct application of electrical energy in the form of high frequency electrical fields or spark discharges or in the form of high frequency sound waves is just now on the way from being a laboratory curiosity to becoming a laboratory success, said Mr. Nielsen, who expressed great optimism in the future use of electronic equipment for accelerating or modifying separation processes and chemical reactions.

Of the three possible methods of making direct application of electrical energy, he saw greatest promise in the use of high frequency (supersonic) sound waves in such separation processes as sedimentation or flocculation. The equipment required is a vacuum tube oscillator, which generates alternating current power at the desired frequency (commonly around 50,000 cycles per second). This power is fed to a converter unit, such as a piezo-electric crystal or a magnetically driven metal bar, immersed in a liquid. The crystal or bar vibrates at the frequency of the oscillator, and thus sets up compression waves in the liquid.

This action produces a number of effects in the liquid. In some cases it can produce emulsions of two liquids usually considered mutually immiscible. Some chemical reactions are accelerated.

The particular effect of interest to waterworks engineers is that of flocculation. In suspensions containing particles with specific gravity only slightly more than that of the liquid in which suspended and with a size above a certain minimum, flocs are formed as soon as the supersonic vibrations begin. With gas in solution, the gas is forced into bubbles of increasing size and so expelled from the liquid. The suspended particles are driven to these bubbles by the pressure of the waves and so the particles are also expelled.

In addition to the physical and chemical effects mentioned before, these waves also have a powerful disintegrating effect on micro-organisms in the liquid where the waves are generated. This particular effect has probably had more study than any other possible application of supersonic energy.

Sound measures flow

Looking at the future in regard to flow metering, it was Mr. Nielsen's belief that somebody was going to put on the market in the next few years a main line meter that will use neither the Venturi tube nor an orifice plate and will not use a mercury manometer instrument. It was said that the principle of this new flow meter has already been proved and patents have been issued.

The principle involved is that of the Doppler effect. The Doppler effect is evidenced by the apparent change in pitch of a locomotive whistle when the train either is approaching or receding from the position of the listener. This change of apparent pitch is directly related to wind velocity and locomotive speed. Exactly the same principle applies to the transmission of sound in water.

Developments in underwater signalling and location equipment during the last few years have provided answers to many of the engineering problems, such as the electronic generation and transmission of pulses of sound waves, the detection of these pulses, and the conversion to flow velocity from apparent frequency shift.

It is probable, said Mr. Nielsen, that there will also be increasing use of electronic techniques in telemetering equipment for the transmission of measurement of flow, level and other variables over long distances. In his opinion, all telemetering equipment up to date has been rather unsatisfactory. And the reason for this has not been the lack of proper transmitting and receiving instruments but rather the vulnerability of the transmission line to many sorts of failure.

In general, telephone circuits or special two wire circuits have been used for transmission of these measurements. Typical troubles are line failures caused by lightning, breakage of wires by snow, wind or falling trees, short circuits or damage by birds or animals, and malicious damage by humans.

The obvious function of electronics in telemetering is to eliminate the transmission line with its failures and to use instead radio transmission. This equipment should be available soon because all the engineering and application problems were worked out during the war period. Radio telemetering systems have been in use in the Far West for some years for reservoir level and dam gate position measurements, and two companies now have on the market battery-operated equipment of this type.

Another type of electronic telemetering, which has proven very reliable, is carrier current equipment. This is guided radio transmission coupled to a power transmission line, along which it travels.

In general, there is not much electronically new in the construction of electronic measuring instruments said Mr. Nielsen. The principal changes in instrument construction caused by the use of electronic techniques have been mechanical rather than electrical. The important gains are: (1) dynamic measuring action with continuous high speed response plus immunity to vibration and (2) entirely new methods of measuring.

The sensitivity, accuracy and speed of electronic instruments are far beyond old standards, and these factors will play an important part in realizing the ultimate objective of building a universal electronic instrument to measure any and all process variables. Furthermore, it should be possible to centralize a large number of measurements at a single location using sensitive elements at the points of measurement connected with an indicator or a recorder in the control room. With suitable selective switches a number of different measurements can be recorded on a single instrument, or many scattered points can be quickly checked with a high speed indicator

AN ENGINEERING NEWS-RECORD FOREIGN REPORT

Seabees Make Materials for Guam Sewer

Harold W. Richardson
Western Editor, Engineering News-Record
(By Airmail from the Pacific Theater of Operations)

***Editor's Note**—Not all of the Navy Construction Battalion projects are big and spectacular. Just as is the case in the States, for every sensational job there are dozens of prosaic, commonplace tasks that make up the bulk of off-shore wartime construction. Nor do the Seabees like to be considered as supermen. In simple sincerity they claim they are merely construction men at work at war. The following story of building an outfall sewer at Guam is an example of an otherwise commonplace job where ingenuity and improvisation made up for lack of materials.*

INCLUDED IN THE PLANS for the extensive Cincpac Advance Headquarters installation on one of Guam's high hills was a 3-mi. sanitary sewer discharging into the ocean through an outfall across a tide-flooded barrier reef. Preliminary surveys were started Nov. 14, 1944, for the selection of one of two alternate routes. Completion was scheduled for the following March 15, when the area was to be occupied by 3,000 persons. The accepted survey called for 6,800 ft. of 12-in. main outfall line, and 10,300 ft. of 6-in. and 8-in. branch lines.

This was not an imposing job nor an impossible schedule, except for one thing—no cast-iron pipe or brick for manholes were on hand. They had been ordered, but had not yet arrived. In fact, the pipe is still "somewhere in the Pacific" other than Guam.

Materials available on the island had to be used, and these materials were simply portland cement and crusher-run coral aggregate. Eventually 700 ft. of 12-in. cast-iron pipe and a few lengths of 8-in. pipe showed up; the larger size being used for the outfall across the reef. Despite lack of materials, the job was completed eight days ahead of schedule.

Two sets of concrete pipe forms were hurriedly obtained from another island; one was for tongue-and-groove connections; the other, for bell-and-spigot type. Another battalion took one set of forms and helped out with pipe manufacture—one of those cooperative deals that are negotiated daily in the Pacific bases—so the project would not be held up for lack of pipe. Concrete from small mixers was shoveled into the molds by hand.

Coral rock from a nearby pit, processed to a maximum ¾-in. size in a 50-ton crusher, was used for aggregate just as it came from the crusher without screening or the addition of sand. However, a wet mix of 8-in. slump was necessary to fill the forms properly. The unreinforced pipe, made with a cement-aggregate ratio of 1:4 and cured for a minimum of five days, proved to be remarkably tough. It handled well with little breakage.

Some 100,000 brick, 2½x4x8 in., were made of the same cement-coral mix for the 80 manholes on the project. These were cast in wooden grid forms set on wooden platforms. The brick plant had to work two shifts to meet the daily demand of 3,000 units and at times the brick had to be used after only 48 hr. of curing. Beach sand, a scarce commodity on Guam, was used for mortar in laying the brick.

All fittings for use at manholes were fabricated on the job from regular 3-ft. lengths of concrete pipe. A special jig was rigged up to take care of the Y's and 45-deg. elbows. Mak-

Fig. 1. Guam outfall sewer anchored to piers across barrier reef.
U. S. Navy photos

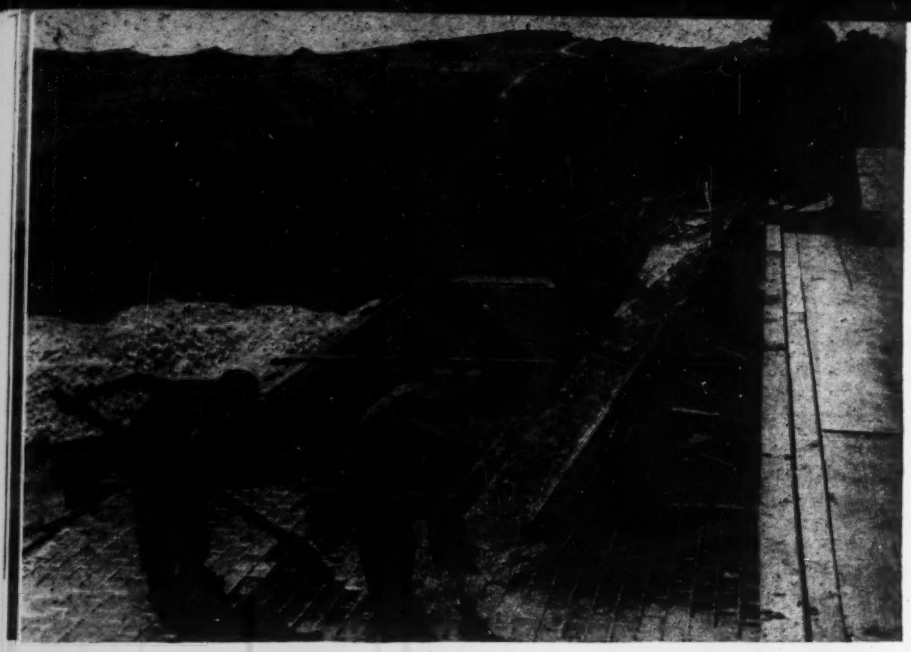


Fig. 2. Concrete brick for 80 manholes were cast in grid forms on a wooden platform. It took 3,000 bricks a day to keep up with the manhole crews.

ing the specials at each manhole, where they were to be used, cut down handling and transportation time to a minimum. Curing time of the completed fittings had to be reduced to less than a week because of the schedule requirements. All fittings were roughly joined on the outside on the first day; the inside was wiped with grout on the following day, and the outside of the joint was finished up the third day. This procedure allowed the longest possible time for curing the critical inside surfaces of the fittings.

Special drop manholes

From the highest manhole in the system to the outfall is a drop of 692 ft. As the concrete pipe carries no reinforcement, and therefore cannot be subjected to internal pressure, it was necessary to develop a series of drop manholes to dissipate the kinetic energy of the flow. Concrete pipe was laid to a maximum grade of 8 percent; minimum grade was 0.7 percent. These grades give velocities of 10 and 2.3 ft. per sec., respectively, with a full pipe and assumption of 0.015 for "N" in Kutter's formula. The sewer is designed for a 100-percent increase in present population.

Drop manholes are of three different types. Where the drop is less than 3 ft. the influent is carried straight through the wall and allowed to fall freely inside the manhole. For more than 3-ft. drops, either outside drop (OSD) or outside drop Wye-tee (OSYT) types were installed. These are shown in the accompanying sketches (Fig. 8).

The OSYT's were built with tumblers, usually three times the diameter of the pipe, including a "bubbler" connection midway between the cleanout and the bottom of the manhole. In one case, where a manhole was not feasible, a short section of cast-iron pipe was installed on a grade of 14 percent. The outside surfaces of the concrete brick manholes were plastered with cement mortar.

To lay the 40 sections of 12-in

Fig. 3. As no vibrating tables were available, home-made concrete pipe for Guam sewer was cast with plenty of muscle-powered rodding.

cast-iron pipe, each 18 ft. long, as the outfall across the barrier reef, a tractor crane was specially waterproofed to operate in 3 ft. of water. The double-drum power control unit was enclosed in a steel plate housing extending up to the tractor floor, welded to the connection between the power unit and the tractor. A canvas covering, with holes for the control levers and the hoist cable, was secured to the steel housing. Then the entire machine was sprayed with a light rust-preventive solution. Finally the starting motor and generator were waterproofed.

Extra servicing and care was given the tractor when it worked in salt water. Track rollers, final drive gears and the transmission were checked every 8 hr. instead of weekly, as is customary. Drain plugs in the steering clutch and master clutch housings were removed when the tractor was out of the water, and replaced when the rig again went into the sea. As a final precaution, the tractor was washed with fresh water and sprayed with rust preventive every four days. When the job was finished the only repairs needed were replacement of the master and steering clutches. Once during the work it was necessary to repair the starter and generator.

Pipe anchored to concrete piers

The outfall pipe sections are supported and anchored by heavy concrete piers at each joint. These blocks also act as an additional joint seal. Simple forms of four sections of ¾-in. plywood, weighted down with sand bags, were bolted around the joint and filled with concrete carried out from shore in a ¾-yd. bucket by the tractor crane. Underwater concrete was placed by the tremie method through a sectional flexible spout made of plywood. Occasionally storm rolling breakers over the reef interfered with the pipe laying and concrete placing, but otherwise no trouble was experienced.

Water depth over the reef varies with the tide from 1 to 3 ft., though the reef rises toward the outshore edge, requiring trenching for the pipe. The trench was excavated by drilling and blasting. Drilling the blast holes with jackhammers while the breakers were rolling over the men was a ticklish job, accomplished, however, without accident.

About 90 percent of the land se

Fig. 4. Much of the land line was laid in deep trenches excavated in old coral. The rock had to be drilled and shot before the backhoe could handle it.

Fig. 5. Deep cuts in coral rock were numerous on the land lines. A-frame hoists aided the crews in setting the pipe.

g. 6. Some of the OSYT-type manholes ere unusually high, as this view shows. mbler section is buried in the right ckground.

Fig. 7. Right: Manhole covers were cast from concrete on the job. Note how the exterior of all manholes was plastered with cement mortar.

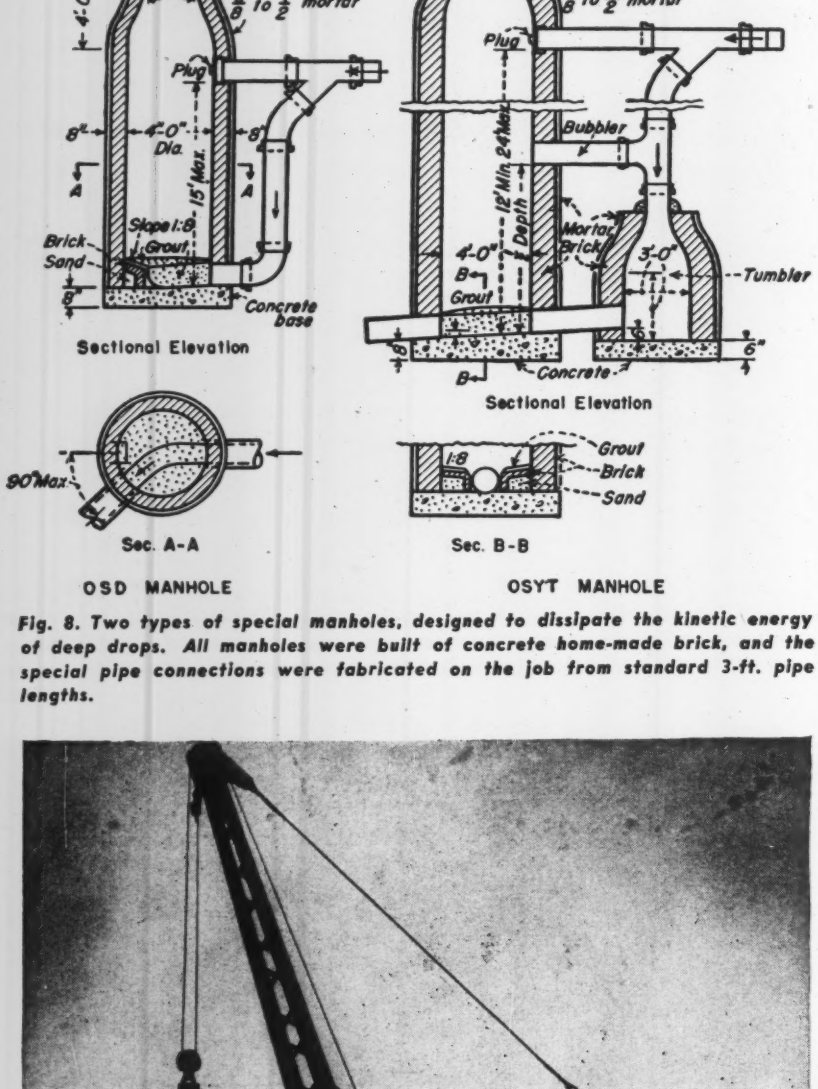


Fig. 8. Two types of special manholes, designed to dissipate the kinetic energy of deep drops. All manholes were built of concrete home-made brick, and the special pipe connections were fabricated on the job from standard 3-ft. pipe lengths.

Fig. 9. A waterproofed side-boom tractor crane placed the pipe and concrete piers for the outfall section across the reef.

tions of the sewer were trenched out of ancient coral rock by drilling and blasting. Most of the shattered rock was removed by a backhoe. Where the cut reached a depth of 32 ft., however, a clamshell was used.

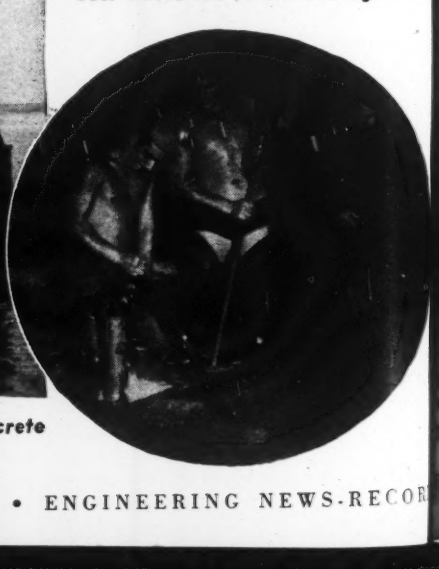
Construction was carried out during the dry season, so little water was encountered. In one spot, however, a spring was uncovered. This was sandbagged off, and a 1-in. pipe drain now carries the water away from the sewer, much to the delight of the natives who use the flow as a new source of water.

The project employed a maximum of 100 men at the peak, divided into specialty groups who moved ahead on functional operations as work progressed. A total of 6,500 man-days of labor completed the job, along with seven pieces of equipment.

Those in charge

Commander Harald Omsted, officer-in-charge of the Seabee battalion that did the job, takes little credit for the job himself. Instead, he lauds the men who directed the work, including Lt. (jg) Nelson R. Hoople, a Socony-Vacuum Oil Co. engineer from East Chicago, Ind., Chief Petty Officer John Jolley, an old timer at sewer construction with eastern contractors, and Carpenter Mates J. W. Williams and R. Estes. These leaders, with their handpicked construction men wearing Navy work clothes, regarded the Guam sewer as just another assignment that had to be completed in a hurry.

Fig. 10. Underwater drilling and blasting prepared the trench for the outfall section near the outshore edge of the reef where the coral rises highest.



London Sewage Disposal Facilities After a Century of Time and Two Wars

M. N. Baker
Associate Editor, Engineering News-Record (Retired)

• Retirement from the *ENR* staff in 1932 has not halted Mr. Baker in his indefatigable search for news of interest to the sanitary engineer. Continued correspondence with a host of friends throughout the world, coupled with the background acquired in a half century of personal observations, has provided the material for numerous articles as well as a book on the history of water treatment, which is now in publication. The following account of London's sewage disposal facilities is based on recent correspondence with the chief engineer of the London City Council prefaced with data obtained on one of Mr. Baker's visits abroad. Mr. Baker celebrated his 81st birthday a few months ago—*Editor*.

ESPONDING TO A REQUEST for information regarding the effect of two Vorld Wars on the treatment of the ewage of the metropolis of London, erson Smith, now chief engier of the London County ouncil has courteously sent e a brief review of events afcting the sewage works since 14. Before giving his letter, owever, it will not be out of ace to review some highlights the history of London sewge disposal during the last ntury.

In March, 1827, complaints ere being made against the d character of the water dewered by the London water mpanies using the Thames a source. One of these prosts, titled "The Dolphin or rand Junction Nuisance", d a frontispiece which owed several sewage outlets, cluding that of the Chelsea ver Hospital, discharging to the river near the "dolin" or intake of the Grand nction Water Works Co. he text described at length e pollution of the Thames, ointing out the danger to ater consumers as seen by hysicians.

This protest led to the early appointment of the first of many British Royal Commissions on Sewage Disposal. Its duty was to investigate the pollution of the Thames and recommend new sources of water supply for London.

Already James Simpson, engineer of the Chelsea Water Works Co., had made his famous journey to the few water filter plants in northern England and southern Scotland and had built a good-sized experimental filter at the Chelsea pumping station on the Thames. In 1829 he put into use the permanent plant commonly known as the first slow sand filter in the world. Other London water companies followed suit, generally moving their intakes farther upstream to avoid the worst pollution.

These changes put an end to Londoners' drinking their own sewage, but did not abate the rapidly growing nuisance caused by the discharge of sewage and industrial wastes into the Thames at numerous points on each side of the river. Public indignation over this nuisance increased greatly whenever dry weather decreased the dilution of the sewage. Bubbles of stinking gas rose to the surface and burst. The polluted air permeated residences, places of business and the Houses of Parliament. Inky black deposits of sludge exposed by low water on the banks and bed of the river gave offense to eye and nose.

The staid London *Times* and the satirical London *Punch* voiced public protest against the nuisance and created a demand for remedial measures. One of the items on the Thames nuisance, published in *Punch*, June 17, 1858, served the double purpose of lampooning the "Stench of London" and promoting the first Grand

THE GRAND NATIONAL ROSE SHOW.
Now Miss Rose: Hold up your Head, & let's see who is the Best Girl'
In the days of the Great Stench of London, the Naiades ran from the banks of Thamesis, with their pocket-handkerchiefs to their noses, and made a complaint to the Goddess Flora how exceedingly unpleasant the dead dogs were, and how that they couldn't abide 'em, indeed they couldn't. And Flora forthwith, out of her sweet charity, engaged apartments at the Hall of St. James's, and came up with 10,000 Roses to deodorise the river, and revive the Town. But Venus no sooner heard of her advent, than (as if to illustrate the severe sentence "women do so hate each other") she put on her best bonnet, and went forth, in all her beauty, to "set down that conceited flower-girl," who had dared to flirt at Chiswick, the Crystal Palace, Regent's Park, &c., with her own favoured admirer, Mars. So, awfully beautiful, she came in a revengeful glow, and Flora's roses grew pale, and fled before the roses on the cheeks of Aphrodite, and the poor goddess went back to her gardens, and the pocket-handkerchiefs went back also, to the noses of the unhappy Naiades.

Lampooning the "Stench of London", this sketch and allegorical note appeared in "Punch" on June 17, 1858. Public indignation and a vigorous campaign for abatement of sewage pollution in the Thames led to the installation of intercepting sewers.

Partial treatment of settled sewage by the activated sludge process is accomplished at the Beckton (formerly Barking) plant completed in 1940.

National Rose Show. It consisted of a pen-and-ink sketch by John Leech, artist of *Punch*, and an allegory by Samuel R. Hole, who was then Dean of Rochester.

In his book *Typhoid Fever* (London, 1873) William Budd describes the stench from the Thames in the hot and dry seasons of 1858 and 1859 as follows:

"For the first time in the history of man, the sewage of nearly three millions of people had been brought to seethe and ferment under a burning sun, in one vast open *cloaca* lying in their midst. . . . . For months together, the topic almost monopolized the public prints. Day after day, week after week, the '*Times*' teemed with letters filled with complaints, prophetic of calamity, or suggesting remedies. At home and abroad, the state of the chief river was felt to be a national reproach. 'India is in revolt, and the Thames stinks' were the two great facts coupled together by a distinguished foreign writer, to mark the climax of a national humiliation." —*Cited by Prof. Gordon M. Fair in "Our Heritage in Sanitary Engineering", Harvard Public Health Alumni Bulletin, May, 1945.*

Disposal by dilution

To cope with the intolerable nuisance, the Metropolitan Board of Works, representing 39 districts, with Sir Joseph W. Bazalgette as chief engineer, built two intercepting sewers leading a dozen miles to Barking on the north and Crossness on the south side of the Thames. These sewers ended in reservoirs, or holding tanks, that were emptied on the outgoing tide. They were completed in the early sixties.

As the volume of sewage increased, however, the terminal reservoirs became inadequate. This and growing objections to the pollution of the Lower Thames with its heavy traffic of vessels led to the appointment in 1882 of a Royal Sewage Commission to propose a remedy. After a long inquiry the commission recommended that the sewage be treated before its discharge into the river.

After experiments had been conducted by W. J. Dibdin, chemist to the Metropolitan Board of Public Works, chemical precipitation was adopted. It was put into use at Barking in the summer of 1889 and at Crossness June 2, 1892. Mr. Dibdin preferred bacterial treatment but had found that four grains of lime and one of proto-sulphate of iron per Imperial gallon effectively expedited sedimentation. These rates of dosing were adopted and with little change had been continued in use up to the time of the writer's visit in 1904.

That chemical precipitation was not regarded as a sufficient means of treatment is shown by the fact that in 1891, about the time of the earliest reports on the work of the Lawrence Experiment Station of the Massachusetts State Board of Health became available, Mr. Dibdin, on order of the London County Council, began experiments on the bacterial treatment of chemically pretreated sewage. Other experiments followed, but not until a half century later was bacterial treatment put into use and then on only a portion of the sewage.

In 1902, the latest year for which figures were available, about 280 mgd. (U. S.) were being treated at both works—163 mgd. at Barking and 116 mgd. at Crossness. The sludge was being shipped to sea.

As it stands now

Pierson Smith's letter, which suggested the foregoing review of a century of London sewage disposal continues the story through the spring of 1945. Here it is stated that:

"Chemical precipitation of sewage with lime and copperas was suspended during the war of 1914–18 owing to the difficulty of obtaining supplies of chemicals. From 1920 to 1935 or thereabouts copperas was used occasionally as a deodorant and since the latter date chlorinated copperas has been used during summer months. About twelve years ago an experimental unit with a capacity of 10,000,000 (Imperial) gallons a day (12 mgd. U. S.) for partial treatment of settled sewage by the activated process was installed at the Northern Outfall Works, Beckton (formerly known as Barking). This was later extended to a total capacity of 60 mgd. (72 mgd. U. S.), the new works being completed in June, 1940."

"Sludge is still disposed of by dumping in the tidal waters of the Thames Estuary. The sludge vessels in use in 1904 have been superseded by larger vessels of about 1,500-tons capacity, which, I understand, closely resemble the ships used for transporting sludge from Ward's Island (New York City), except that the latter are driven by Diesel engines instead of steam."

"During World War II, experiments have been carried out in the preparation of organic manure from crushed household refuse mixed with sewage sludge or screenings. Promising results have been obtained from the compost of screenings with refuse, but the supply of such a product is naturally very limited. However, it does appear to offer a solution to the question of screenings disposal."

Sludge Preheating is Featured In New York's Sewage Plant Design

Contents in Brief *Preheating of sludge in 120-mgd. activated sludge plant planned for treating sewage from New York City's Borough of the Bronx will eliminate digester heating coils. Aluminum heat exchangers utilizing heat of engine cooling water and exhaust gases will heat sludge during pumping. Plant construction may be underway early next year.*

ELIMINATING THE NECESSITY for heating coils in the digestion tanks of New York City's Hunts Point sewage treatment plant, on which contract bids are expected to be asked next year, heat exchangers of unusual design will utilize heat from engine cooling water and exhaust gases to preheat sludge en route to the digesters. Locating these heat transfer units in the basement of the plant's main building eliminates much expensive piping and provides ready access to the heating units for maintenance and repair.

The Hunts Point treatment plant is designed for a present flow of 120 mgd. from a population of 770,000, and an ultimate capacity of 150 mgd. serving 961,000 people. Design and engineering data for the activated sludge type plant are given in the accompanying table, while Fig. 5 shows the plant location and the area served.

Of the four exchangers (Fig. 4), one is for heating raw sludge as it is pumped from the preliminary settling tanks (Fig. 3) to the digesters. Two of the others are for heating waste or thickened sludge from the secondary treatment and the fourth is a standby unit. Suitable interconnections are provided for bypassing the exchangers or for operating them in several combinations.

Aluminum used throughout

Assembled from standard aluminum sections so that special machining is kept to a minimum, the exchanger units consist primarily of 6-in. tubing fastened concentrically within 8-in. pipe. This provides an inner heating tube for flow of sludge and an outer jacket for the flow of the hot water heating medium.

Fastening the inner tube within the pipe is accomplished by flaring the tube ends as shown in Fig. 1 and welding it to the inside of the pipe. The flare is designed to take up the differential expansion between the 6-in. tube and the 8-in. jacket. The 8-in. return bends provided between adjacent passes allow sufficient flexibility for expansion of the units.

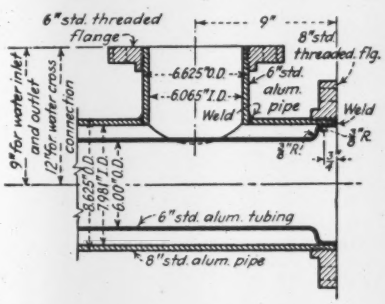


Fig. 1. Fastening 6-in. sludge tube within water jacket is accomplished by flaring ends of tube and welding it inside 8-in. pipe. Bypasses and cross-connections carry heating water.

Sludge is conducted from the end of each pass to the beginning of the next by a standard 8-in. return bend. Water is carried from section to section of the exchanger by bypasses and cross connections (Fig. 2) made from 6-in. standard pipe. All exchanger sections, as well as water and sludge connections, are flanged for ease of maintenance and repair. Standard threaded pipe flanges are used, rubber gaskets being provided to insure tight joints.

In each of the four exchangers, the sludge will enter the top pass of a bank of five, flow back and forth through successive passes to the bottom and then enter the bottom of a second bank of five passes. After flowing through this second bank it will emerge from the top pass for delivery to the digesters.

Heating water will flow in the reverse direction from that of the sludge to provide maximum efficiency in the heat transfer.

Heat recovered from engines

Hot water for the exchangers is obtained by recovery of heat from the gas engine jacket cooling water sup-

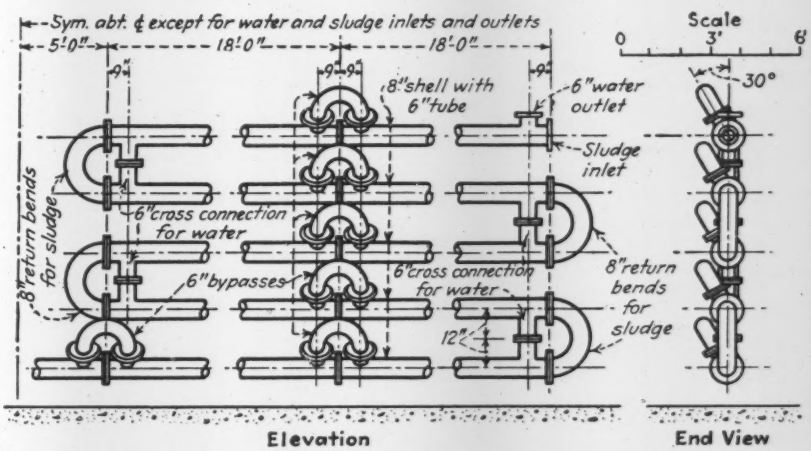


Fig. 2. Heat exchangers built up of standard aluminum sections transfer heat from hot water to sludge as it is pumped from settling tanks to digesters.

plemented, as necessary, by heat recovered from the engine exhaust gases through exhaust gas steam boilers and steam to water converters. The closed system uses city water, thus reducing scaling to a minimum when the water is heated. Under extreme cold weather conditions, provision is made for additional heating of the water by gas or oil fired boilers.

At maximum sludge heating load conditions, the water, in passing through the heat exchanger, will drop from 138 deg. to 118 deg. F., giving up its heat to the sludge. The latter is raised from its 50 deg. temperature to one of 108 deg. Thus, the water will be cooled to proper temperature for return to the engine jacket. In case sludge heating does not cool the water sufficiently, under some load conditions, for maximum engine efficiency, provision is made for further temperature reduction by means of auxiliary exchangers using effluent water as the cooling medium.

Heat transfer considerations

Construction of the sludge heaters calls for the use of aluminum throughout. Although the heat transfer factor for bright and clean aluminum is higher than that of copper or steel, consideration of thickness and size factors in this installation reduces to a negligible quantity the difference between heat exchange coefficients of the materials. The choice of aluminum, therefore, was based primarily on its corrosion-resisting properties.

A factor that under some conditions might seriously reduce the flow of heat in the exchanger is grease deposition on the interior of the sludge pipe. No trouble is foreseen from this cause, as the temperatures involved are high enough to melt the grease, yet too low to cake the sludge. As a precaution, however, provision is made for cleaning the sludge lines with either live steam or hot water.

Loss of heat from the exchangers is minimized by pipe covering on all their parts. In addition, sludge lines from the heaters to the digesters are heavily insulated. Radiation heat losses from the digestion tanks are reduced by an insulating air space between the tank walls and brick veneer architectural treatment and by insulation on the roofs. These pre-

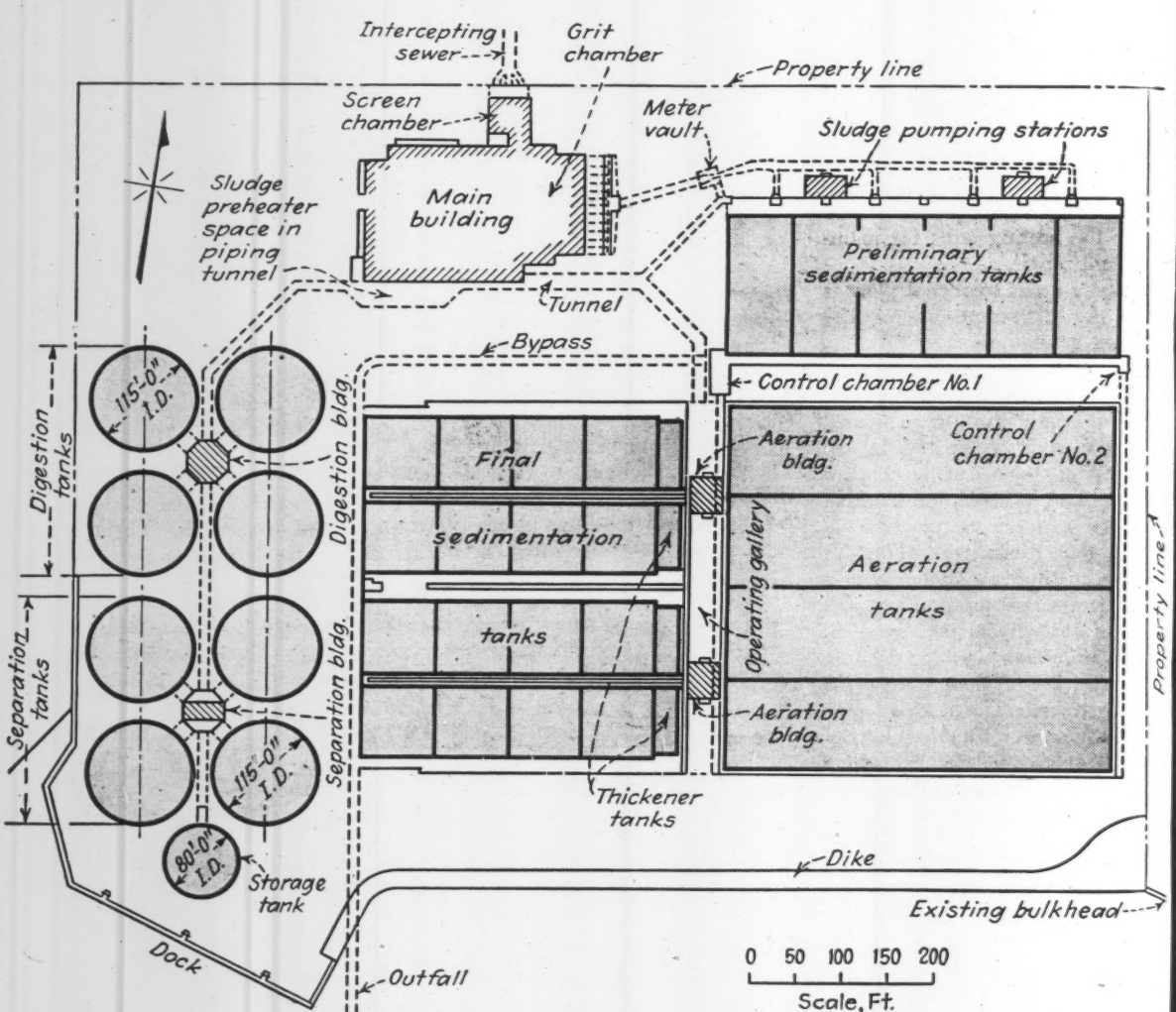


Fig. 3. Compact arrangement of structures dictated by site restrictions and foundation problems aids design aims of short piping and preheating of sludge. Location on East River waterfront permits close approach of sludge vessels and discharge of effluent directly to deep water.

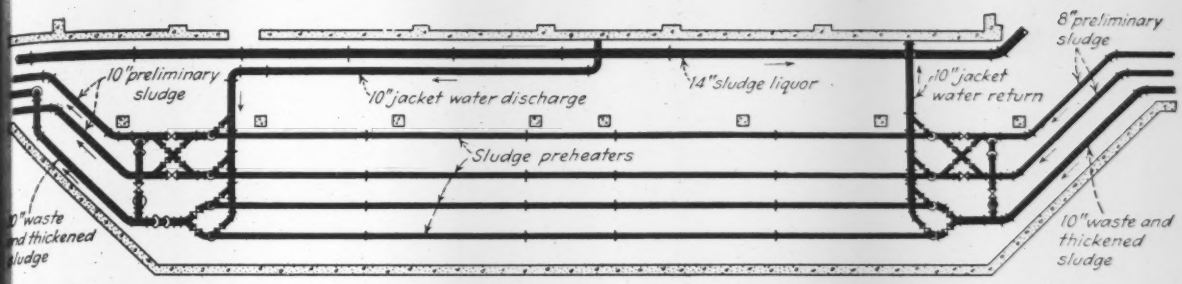


Fig. 4. Location of aluminum heat exchangers in basement of main building facilitates sludge preheating by recovery of heat from engine jacket cooling water and exhaust gases.

...utions against heat escape are ...signed to maintain a temperature ...f 85 deg. F. in the digesters under ...erage winter conditions at the site. ...As an additional precaution against ...w temperatures in the digesters two ...irect steam heaters are provided in ...he sludge control building. Each ...f these heaters has a capacity for ...ding about 25 percent of the maxi...um sludge heating demand to ...udge circulated by means of pumps.

Unit of 17-plant program

The Hunts Point plant constitutes ...major project in New York City's ...ng-term program for improvement ...f its sewage disposal facilities. This ...rogram, aimed at reduction of pol...tion in waters adjacent to the metro...olitan area, originally called for ...me 32 treatment works; later ...udies led, through combination and ...rrangement of sewer districts, to ...doption of the present plan calling ...r 17 plants, 15 of which will fur...sh secondary treatment.

Six of the plants are already in ...eration. Four of these—Wards ...land, Tallman's Island, Bowery Bay ...d Jamaica—use the activated ...dge process, while the Coney Island ...rks employs chemical precipita...n in summer and plain sedimenta...n in winter. The 26th Ward plant, ...hough designed as an activated ...dge plant, is a "war casualty" and ...present provides only plain sedi...ntation. Present combined capac...of the six plants is 455 mgd.

Treatment at Hunts Point plant

The Hunts Point plant will treat an ...ditional 120 mgd., with provision ...r future expansion to 150 mgd. ...pacity. The activated sludge ...ocess was selected as best suited to ...al treatment requirements and to ... broader objectives of the New ...rk program.

Treatment facilities at Hunts Point provide that sewage entering the plant will be screened, then raised by pumping to a higher level for grit removal and preliminary settling. Primary sludge will pass through preheaters en route to the digesters, while effluent from the primary treatment will be mixed with return activated sludge, aerated and passed through final clarifiers.

Excess activated sludge will be

DESIGN AND ENGINEERING DATA

Area Served: **15,613 acres in Borough of The Bronx, New York City.**

Population Served: **Present, 700,000; design, 770,000; ultimate, 961,000 (est. 1970).**

Capacity: **Present, 120 mgd.; ultimate, 150 mgd.**

Treatment: **Activated sludge; sludge thickening and digestion with gas utilization. Digested sludge barged to sea; washed grit used as land fill; coarse screenings trucked to incinerators or dumps; fine screenings ground and passed through plant. (Note: After passing screen chamber all sewage must be pumped through 32-ft. lift.)**

Screening Chamber: **Three channels, each equipped with bar screens having 3-in. clear spacing, followed by mechanical bar screens with 1-in. spacing and screenings grinders.**

Pumps: **Two units each 50 mgd., two units each 70 mgd., one unit 60 mgd., all at 32-ft. head. Second 60-mgd. unit to be installed for ultimate capacity needs.**

Grit Chamber: **Twelve channels 70 ft. long, two serving each pump. Four, 6.67 ft. wide; four, 8 ft.; and four, 9.33 ft.**

Primary Clarifier: **Four tanks, 108x168x12 ft. deep. Detention period for design flow 1.25 hr.; for ultimate, 1.0 hr.**

Aeration Tanks: **Four units with 4 passes each. Each pass 25x438x15 ft. deep. Detention period for design flow plus 25 percent return sludge, 3.0 hr. Swing-type air diffusers.**

Final Clarifier: **Sixteen tanks with 4 channels each. Each channel 19.5x94.5x14 ft. deep. Detention period, 2.5 hr. Settling rate, 1,000 gal. per sq. ft. per day.**

Sludge Digesters: **Four fixed-cover type tanks, 115-ft. dia.; sidewall depth, 32 ft.; no heating coils; liquid capacity, 360,000 cu. ft. each.**

Sludge Separation Tanks: **Two fixed-cover and two movable-cover type units; 115 ft. dia.; sidewall depth, 34.5 ft.; detention period based on ultimate average solids production, 25.8 days; gas-holder capacity in two units, 300,000 cu. ft.**

Sludge Thickeners: **Four rectangular tanks 29.5x94.5x14 ft. deep. Settling rate for excess sludge, 75 gal. per sq. ft. per day; for aeration tank effluent 500 gal. per sq. ft. per day.**

Sludge Storage: **One 85-ft. dia. tank with gravity discharge to sludge vessels. Liquid capacity, 110,000 cu. ft.**

Outfall: **Concrete; length 300 ft.; size, 9x9.75 ft. Effluent dispersed into 25-ft. depth of tidal water.**

Gas Engines: **Four units, rated 900 hp. each. Two direct-connected to blowers; two, to blowers through electric motor generators by pneumatic couplings.**

Blowers: **Four units, each rated 21,000 cfm. at 8 lb. per sq. in.**

Designers: **Greeley and Hansen, Chicago and New York consulting engineers.**

Cost: **$9,000,000 (est.).**

thickened, then preheated during pumping to the digesters. Digested sludge will be dumped at sea.

Unusual engine combination

Gas recovered from sludge digestion will furnish fuel for four 900-hp. gas engines driving rotary positive displacement blowers, two of the engines being direct-connected to air blowers.

The other two will be connected to blowers through intermediate electric motors. Each of these two units is expected to employ special pneumatic couplings between engine and motor, and also between motor and blower, so that the units can be operated as engine-driven blowers with motors idling, as motor-driven blowers with engines disconnected, or as engine-driven generators with blowers disconnected.

Bids for the major contract for the new plant are expected to be solicited sometime next year, with construction following immediately. Completion of the works and necessary intercepting sewers is estimated to require three years.

Designs for the plant were made by Greeley and Hansen, consulting engineers of Chicago and New York, for the Department of Public Works, New York City. For the department, R. H. Gould is director of the Division of Engineering and W. Donaldson is chief of the Bureau of Sewage Disposal Design.

Fig. 5. Hunts Point plant serving most of the Borough of The Bronx will reduce pollution of tidal waters in New York area by activated sludge treatment.

Indiana Cities and Industries Share Costs of Sewage Disposal Service

Joint use of sewerage and treatment facilities by industries and municipalities leads to the question of how much of the cost of these services should be borne by the industries. How Indiana cities have solved this problem is shown by data from four representative communities of that state furnished by J. L. Quinn, acting director of the state Board of Health's division of environmental sanitation.

One example of cooperation in sharing costs and in the joint use of sewage disposal facilities is found in Tipton, a city of 5,100 population. There, the minimum charge for industrial users is $2.80 per month as compared with 50c. for commercial users. Monthly rates for industrial users, per 100 cu. ft., are as follows:

First 2,500 cu. ft.	$0.112
next 2,500 cu. ft.	0.085
next 15,000 cu. ft.	0.065
next 25,000 cu. ft.	0.03
over 45,000 cu. ft.	0.011

In contrast to this commercial users are billed monthly for each 100 cu. ft. in accordance with the following schedule:

First 300 cu. ft.	$0.14
next 500 cu. ft.	0.112
next 865 cu. ft.	0.055
next 1,667 cu. ft	0.025
next 6,668 cu. ft.	0.011
next 15,000 cu. ft	0.0055
next 50,000 cu. ft	0.003
over 50,000 cu. ft	0.0014

Special rate for cannery

All industrial and commercial contributors to sewage flow in Tipton are billed according to these schedules with the exception of one canning plant. This plant, according to City Manager W. N. Yoder, has elected to pay under an optional provision whereby packers of food products may, by special agreement with the city, pay $1 for each 1,000 cases canned or packed per calendar year. In such case the minimum yearly charge is $300. If, however, the plant does not operate during any year, it is charged for that year under the established commercial service rate schedule.

Both Peru and Muncie, with populations of 12,400 and 49,700 respectively, charge industrial users at the same rates as residential users. Peru's straight rate based on volume, however, is not used in Muncie, where charges per 1,000 cu. ft. per quarter are in accordance with the following rate schedule:

First 1,000 cu. ft. or less	$1.75
next 19,000 cu. ft.	.50
next 80,000 cu. ft.	.45
next 400,000 cu. ft.	.40
next 500,000 cu. ft.	.30
over 1,000,000 cu. ft.	.15

These quantities are figured on the amount of water used, regardless of the source of supply.

I. V. Pence is superintendent of public works at Peru, while Paul R. White is superintendent of Muncie's sewage treatment plant.

Cooperation at Fort Wayne

In the larger population group, Fort Wayne, with 118,400 people, charges industries a straight rate based on volume of effluent discharged into the sewers. Although an ordinance permits charging special rates for concentrated wastes, that special rate has never been applied even though, on occasion, "shots" of industrial wastes highly deleterious to the activated sludge treatment process have been dumped into the sewers by several industrial plants.

This condition has been corrected to a great extent, however, by having the industries at fault change their dumping method to one of gradual discharge over a number of hours. This practice results in sufficient dilution of the wastes to keep them from seriously interfering with the sewage treatment process, according to Ralph A. Hoot who is superintendent of the municipal plant.

While the charges levied by these four cities are believed to be representative of other Indiana cities where sewer service rates are charged, there are, of course, many places that have no such rate structure. Cost of sewerage service and treatment facilities in these cases is shared by general taxation

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

New Precipitation Gage Used by Weather Bureau

To permit accurate measurements snowfall in the mountainous areas the West, U. S. Weather Bureau gineers have developed the new pe storage precipitation gage illus- ated. The container is in the shape a frustum of a cone with a stand- d 8-in. dia. orifice and side slopes 6 to 1. This shape permits snow fall freely inside the gage and re- ces bridging of the orifice by snow hering to the inside walls, a com- on occurrence with a vertical-walled ge.

Since the gage will often be in- alled at extremely remote locations th infrequent attendance, the con- iner must be of large capacity. Four es have been designed with nominal pacities of 60, 100, 200 and 300 in. precipitation, the equivalent of 300 of precipitation being 120 ft. of owfall. The variation in capacity is hieved by varying the height of e gage container, that of the 200-in. pacity being 51 in. tall.

A calcium chloride brine is placed the container to melt the snow as falls and to prevent the container om being filled by snow. A gage pable of holding a charge of 30 rcent calcium chloride equivalent the estimated normal annual pre- itation, is used. A thin film of light on top of the contents reduces aporation losses to wholly negligi- amounts.

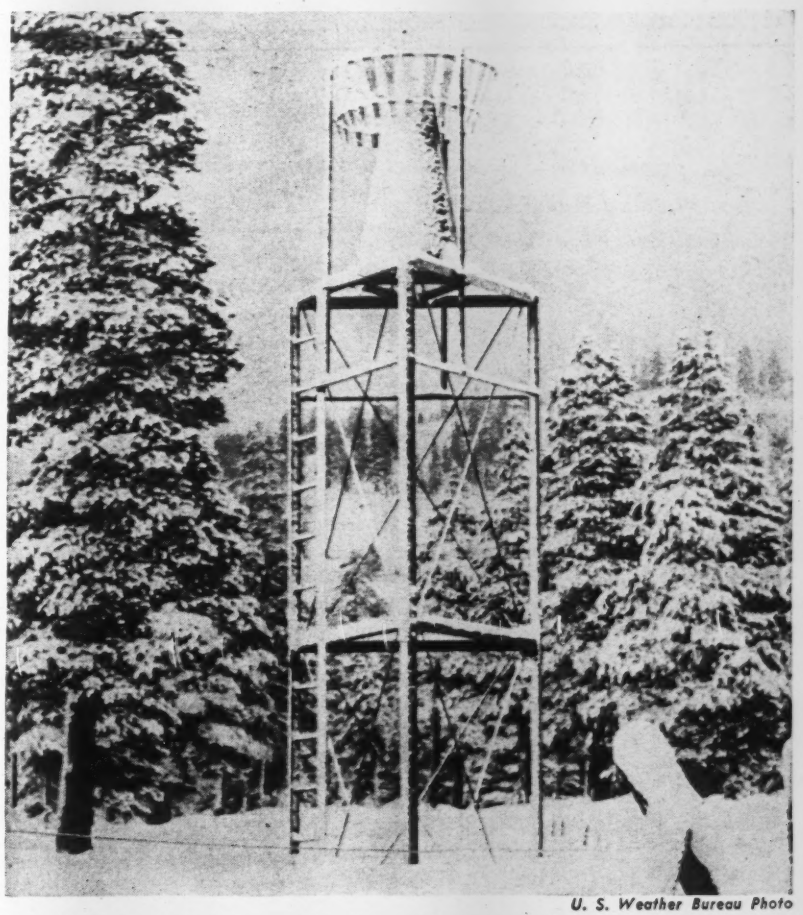
Such a gage can be left unattended oughout the year.

The steep outside slope of the gage lls and the absence of projecting oulders reduce interference from t snow adhering to the gage but not prevent it entirely. The con- ners are painted flat black to make st effective use of solar heat in lting snow accumulations on the erior and to aid in keeping the ntents liquid should the brine be- me overly diluted.

The gages are equipped with drain ves so that the contents may be hdrawn and weighted to determine the catch. To avoid the need of re-charging, however, interim measurements during the course of the season may be made by stick measurement, the depth being converted to inches of precipitation by means of a rating table.

The triangular tower is especially designed to suport the largest of the new gages when full, a load of some 700 lb. Towers as high as 21 ft. are erected, being assembled of 7 ft. units. The shield about the top of the container is of standard design, and is of heavy gage metal throughout, being supported at three points instead of the usual two.

Design and construction of the first gages was at Sacramento, Calif., under supervision of Weather Bureau technicians assigned to mountain snowfall investigations. Further tests are being made at Soda Springs, Calif., in cooperation with the University of Nevada Agricultural Experiment Station. An installation at Stampede Pass, Wash., withstood a 90-mph. wind—RAY K. LINSLEY, JR., *hydrologic engineer, U. S. Weather Bureau, Washington, D. C.*



U. S. Weather Bureau Photo

Gages capable of holding 200 in. of precipitation are mounted on high towers and left throughout the winter to record snowfall in remote areas. Gage is charged with anti-freeze solution to melt the snow as it falls and to prevent the liquid from freezing and bursting container. Windshield of slatted framework around top of gage reduces the influence of wind on amount of snow deposited.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Bridge Specifications

STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES—Fourth Edition. 262 pp. American Association of State Highway Officials, National Press Bldg., Washington 4, D. C. $3.

The major changes made in this new edition of the A.A.S.H.O. specifications for fixed highway bridges relate to loadings. Axle spacings for the standard trucks have been modified to provide a more appropriate loading for continuous spans, thus reducing the loading for larger spans. The authors state that these are justified by experience in rating existing bridges and the improbability of many heavy units being in close proximity on a long span at one time. Lane loadings also have been modified by reducing the concentrated loads, and minimum widths for bridges have been increased.

Arc Welding Handbook

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE—1,282 pp. Lincoln Electric Co., Cleveland 1, Ohio. $1.50.

Experience gained through the application of welding to war work formed the basis for a complete revision of this handbook, which is now in its eighth edition. New material in the parts of the book relating to welded structures include continuous beam and column connections, anchor attachments to column bases, box-shaped angle columns, gusset-plate truss joints, and bridge expansion joints.

Framed Structure Design

TRANSLATION KEY TO KLEINLOGEL RAHMENFORMELN—By F. S. Morgenroth. 42 pp. Frederick Ungar Publishing Co., New York. $1.25.

Last year the eighth edition of Rahmenformeln by A. Kleinlogel was reproduced in German in this country under authority of the Alien Property Custodian (*ENR* Dec. 14, 1944, vol. p. 775). This little book, as the title indicates, is to help those unfamiliar with German to use the Kleinlogel book with its formulas for 114 different types of structural frames. Also included is a German-English vocabulary of terms used in the original German text.

Traffic Studies

MANUAL OF TRAFFIC ENGINEERING STUDIES—118 pp. Traffic and Transportation Division, National Conservation Bureau, 60 John St., New York 7, N. Y. $2.

How traffic studies should be made and how they should be interpreted is told in this new manual, which is an expansion and revision of the Traffic Survey Manual, first published by the National Conservation Bureau in 1937. Case studies are used, there being one for each of twenty major elements that go into a complete traffic study.

The home-interview method of determining potential traffic volume, recently developed by the Public Roads Administration, is not included.

Miscellaneous Notes on Booklets and Reprints

AN AUTOBIOGRAPHY reviewing the experience and tribulations of a municipal official under the title "The Public Service of George Grimm Jr." has been privately published by Mr. Grimm, 3127 Locust St., St. Louis. After having retired from city service in 1933, Mr. Grimm was recalled in 1942 to help the Department of Streets and Sewers in getting priorities for needed work, which position he held until 1944.

A. S. T. M. STANDARDS for Concrete and Concrete Aggregates have been assembled in a 141-page pamphlet bearing that title. Copies may be obtained from the American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa., for $1.50. Included are standards for cement, concrete reinforcement, preformed joint fillers and sieves for testing purposes. Test specifications also are given.

RECREATIONAL FACILITIES as war memorials are described in considerable detail in a pamphlet "More About Memorials That Live" issued by the American Commission for Living War Memorials, 30 East Broad St., Columbus, 15, Ohio. The brochure is a supplement to one published last December under the title "Memorials that Live."

New Engineering Books

PLANNING YOUR HOME FOR BETTER LIVING—By Clarence W. Dunham, and Milton J. Thalberg. 278 pp. McGraw-Hill Book Co., New York 18. $4.

PERSIAN GULF COMMAND—By Joel Sayre. 140 pp. Random House, New York. $2.

TRANSLATION KEY TO KLEINLOGEL'S RAHMENFORMELN—By F. S. Morgenroth. 42 pp. Frederick Ungar Co. New York. $1.25.

PROCEEDINGS OF THE AMERICAN RAILWAY ENGINEERING ASSOCIATION—Volume 46. American Railway Engineering Association. 59 E. Van Buren Street, Chicago 5, Ill.

STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES—American Association of State Highway Officials. Fourth Edition. 262 pp. Published by the association, 1220 National Press Building, Washington, D. C. $2.

ATOMIC ENERGY FOR MILITARY PURPOSES—By Henry D. Smith. 264 pp. Princeton University Press, Princeton, N. J. $1.25 (paper) $2.00 (cloth).

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE—8th Edition. 282 pp. Lincoln Electric Co., Cleveland, 1, Ohio. $1.50.

THE MACHINISTS' AND DRAFTSMEN'S HANDBOOK—By Albert M. Wagener and Harlan R. Arthur. 662 pp. D. Van Nostrand Co., New York. $4.50.

WHERE SCIENCE IS WRONG—By Edward Godfrey. 142 pp. Published by the author, Professional Building, Pittsburgh 22, Pa. $1.50.

TRAINING FOR SUPERVISION IN INDUSTRY—By George H. Fern. 188 pp. McGraw-Hill Book Co., New York 18 and London. $2.

PLASTICS, 3rd Edition—B. J. H. DuBois. 447 pp. American Technical Society, Chicago. $4.

Reports and Pamphlets

THE ROAD AHEAD—American Road Builders' Association, 1319 F Street, N. W. Washington 4, D. C.

PLANNING PAYS PROFITS, The Story of San Diego—California State Reconstruction and Reemployment Commission, Sacramento, Calif.

SALVAGING OLD HIGH TYPE FLEXIBLE PAVEMENTS—No. 10, Wartime Road Problems. Highway Research Board, Washington 25, D. C.

(*Continued on p.* 164)

LABOR *and* MANAGEMENT MEET— *for* PEACE *or* CIVIL WAR?

THE prospect of a knock-down and drag-out fight in the automobile industry does not augur well for the reconversion outlook, which upon every other score is bright. Any widespread outbreak of the type of industrial warfare which now threatens will disrupt, more thoroughly than anything else on the horizon, an orderly transition to a peacetime economy.

It is doubly unfortunate that there should be a general tightening of union and company battle lines upon the eve of the Labor-Management Conference, which on November 5th will convene at President Truman's direction for the purpose of "working out by agreement means to minimize labor disputes." If the current work stoppages occasioned by industrial conflicts should increase rather than diminish between now and November first, the Conference atmosphere hardly promises to be favorable to a dispassionate examination of basic issues.

Yet the shadow of the threatened industrial storm that hangs over the Conference only serves to emphasize the importance of reaching satisfactory agreement upon two problems with which such a Conference might deal. The first is that of determining what machinery shall be used for settling disputes upon which employers and workers have reached an impasse. The second, and more far-reaching, is that of arriving at some common understanding upon the major issues which commonly lead to irreconcilable disputes.

Settlement of Wartime Disputes by the War Labor Board

During the war the first problem was handled largely by machinery centered in the National War Labor Board. Supported by general adherence to patriotic pledges by labor leaders and employers not to resort to the use of economic force against each other during wartime, and backed up on rare occasion by use of the President's power to seize plants for war purposes when its orders were not obeyed, the Board managed, by what amounted to compulsory arbitration, to settle the nation's wartime labor disputes with relatively little economic loss.

But it can scarcely be claimed that the War Labor Board did much to resolve the issues from which disputes grow. Indeed, the fact that it was available to issue orders in cases which the Secretary of Labor certified as likely to "lead to substantial interference with the war effort", resulted in the conversion into full fledged disputes of many disagreements which would otherwise have been settled at a local level in the course of collective bargaining. Meanwhile, local collective bargaining machinery which should have been doing most of this work was neglected, and will need thorough reconditioning even to be brought back to its prewar level of effectiveness.

With V-J Day came an abrupt change in the status of the War Labor Board. One of its main props, labor's "no strike pledge", was promptly withdrawn. It could no longer rely on the President to use his power to seize plants for war purposes to force obedience to its orders. Consequently the Board agreed that it would accept new cases only if both parties to the dispute stipulated in advance that they would abide by the Board's findings, that it would clear its dockets of old cases as rapidly as possible, and that it would then go out of business, leaving to the Labor-Management Conference the question of what should take its place in the postwar period.

What Shall Take the War Labor Board's Place?

The immediate and pressing task of the Labor-Management Conference is to agree upon machinery for settling industrial disputes in the peacetime economy.

Neither management nor labor wants the continuation of compulsory arbitration to which they submitted as a necessary war measure. But it must be clear to everyone that if any substantial proportion of the disputes that inevitably arise are settled by resort to strikes and lockouts, economic anarchy will result. Not only will it be impossible to achieve the high levels of output and employment that have been set as postwar goals, but it is questionable whether our economy could survive. The only alternative to compulsory arbitration under government auspices is for management and labor to demonstrate their ability to effect a peaceable resolution of their differences without it.

The most obvious need is to set up local machinery at the grass roots where disputes originate. That is where most of them should be settled by local negotiation and, when that fails, through voluntary submission to mediation or arbitration under terms of reference to which the parties agree. Many issues, which at plant level are relatively simple in character, are blown up to formidable dimension and complexity when they are passed along

the line for decision in Washington. The centralizing process is one that frightens everyone connected with it because it focuses attention upon the possible importance of precedents established by a decision, rather than upon resolving satisfactorily the particular dispute at hand.

Unquestionably, some Federal machinery must be provided which may be called upon in cases where the size or implications of a threatened dispute clearly run beyond local jurisdiction. That will mean the thorough revamping of conciliation and mediation machinery which exists, but which has grown rusty through disuse while compulsory arbitration was the order of the day.

At least, this involves a complete overhauling of the United States Conciliation Service with a noteworthy strengthening of its personnel. There may be wisdom also in recently advanced suggestions for the creation of a board of arbitration to act in cases voluntarily submitted by the parties concerned, and for boards of inquiry to make reports upon the merits of disputes in which the public interest is concerned. But there is valid ground for questioning what appears to be the common assumption that such machinery should be located in the Department of Labor. It belongs neither there nor in the Department of Commerce. For the work which such agencies are called upon to perform, both the appearance and fact of complete impartiality are essential to effective performance. Assurance of impartiality will not be fostered by placing them in a department specifically charged by Congress with the task of advancing the interests of wage workers.

Resolving the Issues Over Which Disputes Arise

It may be, as many think, that the forthcoming Labor-Management Conference cannot effectively handle any problems beyond the procedural ones suggested above. If that is true, its agenda probably should be restricted to planning the reconstitution of collective-bargaining and dispute-settlement machinery, in view of the urgent need for putting it in working order.

But either in this Conference, or in subsequent ones, there will have to be an attempt to reach a reasonable measure of labor-management accord upon certain basic issues over which most industrial disputes originate. The best of machinery can be swamped if disputes are generated in ever-increasing number.

Most important of such issues is that of the fair determination of wages. There is clear need for reaching agreements at least upon the major factors on which such determination should rest. It seems evident that if we are ever to hope to reach the high levels set and generally accepted as postwar goals, we must harness economic incentives to promote production efficiency. That means that workers, as well as management, must be given a genuine stake in increased productivity. No universal formula is possible, but we should be able to agree upon general principles for dividing returns derived from improved performance in output between workers and investors, and consumers in the form of lowered prices.

Again, since unionism is here to stay, general acceptance by management of the principle of collective bargaining would save innumerable disputes which are concerned more with the method of negotiation than with the concession sought. Few in management still question the validity of the collective bargaining process as such, but there are many matters to be resolved of which the question of the open shop, the union shop, or the closed shop is merely a conspicuous example, upon which there is wide divergence of conviction between and within labor and management groups.

On the management side, there is sincere concern about the intent or ability of union leaders to exercise responsible control that assures compliance with contractural obligations. Wild-cat strikes are of sufficiently frequent occurrence to give substance to this distrust, and union discipline seldom has been administered in a decisive or effective fashion. The prospective rivalry of three competing labor organizations of national scope gives management little confidence that a bargain made and kept in good faith with any one of them provides assurance against work stoppages.

All of these matters, and many others, need thrashing out between management and labor, with the view of arriving at as large a measure of specific and detailed agreement as can be achieved. The greater the area of such agreement, the smaller will be the area for disputes that must be handled by settlement machinery, or put to the final test of force.

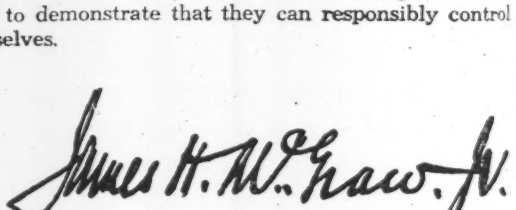
Peace or Civil War in Industry

The Labor-Management Conference is of major importance to national welfare. It is important even if it restricts its objectives to the procedural problem of how industrial disputes are to be handled.

It can make an even larger contribution if it lays the groundwork for an attempt to reach working agreements upon such policy issues as have been cited above.

Neither management nor labor can afford to lend anything less than their best intelligence and effort to an attempt to arrive at common understanding. Success will mean that we have a genuine chance of reaching new levels of economic well-being. Failure will mean industrial civil war, in which the casualties will be high. One almost certain casualty of such a war will be the principle of collective bargaining, since the Government can scarcely refrain from establishing compulsory arbitration if sufficient breakdown occurs.

It is to the vital interest of both management and labor to demonstrate that they can responsibly control themselves.



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CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

WASTEWAY, COACHELLA CANAL CALIFORNIA

OWNER: U. S. Bureau of Reclamation, Yuma, Ariz.; John K. Rohrer, acting construction engineer.

PROJECT: Earthwork, concrete lining and structures for Wasteway No. 1 (Sta. 3 + 96.5 to Sta. 176 + 83) running from Sta. 4782 + 01.6 of the Coachella Canal to the Salton Sea. Work is located 20 miles southeast of Indio, Calif. Structures to be built include bearing piles for bridge abutments, raiload bridge and highway bridge, in addition to the wasteway-channel lining and the wasteway outlet structure.

CONDITIONS: Contractor to furnish all form materials; spikes and nails; wire and wire ties; temporary supports; water; sealing compounds; embankment and backfill materials; rock and rock spalls; gravel and crushed rock; welding rods; and all other materials not part of completed structure, but required for completion of work. Time for completion 240 calendar days. Rail and highway transportation facilities available near site of work. Employment of prisoners of war, enemy aliens and Japanese-born Americans may be utilized if approved by proper federal agencies having control. Wage rates specified are: skilled labor, $1.35 to $1.75 per hour; semi-skilled, 95c. to $1.40; and common labor, 95c. per hour.

BIDS: Five bids were received August 15, 1945, and three more were received after the bid opening as a result of the unofficial V-J Day holiday delay in mail deliveries. The eight bids ranged from the low of $298,472 to $441,149.

LIST OF BIDDERS:

1. Ralph A. Bell, Monrovia, Calif. (low bidder) — $298,472
2. Fisher Contracting Co., Phoenix, Ariz. — 320,904
3. E. B. Bishop, Orland, Calif. — 322,375
4. Guerin Bros., South San Francisco, Calif. — 346,369
5. M. H. Hasler, Santa Ana, Calif. — 357,672
6. Charles J. Dorfman, Los Angeles, Calif. — 369,410
7. Spencer Webb and Frank T. Hickey, Los Angeles, Calif. — 392,840
8. W. E. Kier Constr. Co., Hollywood, Calif, and Bressi-Bevanda Constructors, Inc., Los Angeles, Calif. — 441,149

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excavation for wasteway channel	155,000 c. y.	$0.32	$0.34	$0.30
2. Excav. for temporary RR relocation	2,400 c. y.	.40	.39	.20
3. Excavation for structures	1,400 c. y.	1.50	1.40	.75
4. Compacting embankments	250 c. y.	1.50	2.00	.50
5. Compacting sub-base	100 c. y.	1.50	.76	1.00
6. Trimming foundations for concrete wasteway lining	57,500 s. y.	.33	.68	.47
7. Backfill about wasteway-channel side walls	9,000 c. y.	.40	.46	.15
8. Backfill about structures	4,140 sta. c. y.	.40	.65	.25
9. Compacting backfill	1,140 c. y.	1.75	.78	1.00
10. Rockfill	800 c. y.	5.00	3.90	6.00
11. Conc. in wasteway-channel lining	9,700 c. y.	15.50	13.90	18.00
12. Conc. in wasteway outlet struct.	272 c. y.	34.00	33.20	35.00
13. Concrete in highway bridge	157 c. y.	34.00	70.00	35.00
14. Concrete in railroad bridge	176 c. y.	34.00	37.10	35.00
15. Place reinforcement bars	898,000 lb.	.03	.03	.03
16. Place elastic filler material in joints	37 s. f.	2.00	1.20	1.00
17. Place rubber water stops in joints	50 l. f.	2.00	1.00	1.00
18. Manufacture and drive 30-ft. conc. piles	16 ea.	187.00	410.00	150.00
19. Manufacture and drive 45-ft. conc. piles	27 ea.	280.00	440.00	230.00
20. Drive struct. steel bearing piles	2,450 l. f.	1.50	2.36	2.15
21. Erect structural steel	52,000 lb.	.04	.02	.03
22. Install miscellaneous metalwork	1,900 lb.	.30	.35	.20
23. Erect timber in structures	1.5 M bm.	100.00	300.00	100.00

BRIDGES APPROACHES, BAY COUNTY, FLORIDA

OWNER: State Road Dept. of Florida, Tallahassee; J. H. Dowling, state highway engineer.

PROJECT: Bituminous paving north and south approaches to bridge across North Bay at Lynn Haven, Bay County, Florida. Project, located on State Road No. 52, is 1.335 miles in length. Includes necessary clearing and grubbing; excavation; hydraulic embankment (56,358 cu.yd.); muck blanket; sand bituminous road mix, 6-in. thick; bituminous material (sand bituminous road mix and cut-back asphalt); 106 sq. yd. of reinforced cement concrete pavement 9-in. thick; concrete for structures; pipe culverts; relaying existing side-drain pipes; treated timber and sheet piling; inlets and manholes; sidewalks; sprigging; removal of existing concrete pavement and sidewalks; and other appurtenant work required for completion of the project.

CONDITIONS: Contractor to furnish all materials and complete project in 180 working days. Highway and water transportation facilities at project site and rail facilities available to Panama City. Wage rates stipulated are those prevailing in the area.

BIDS: Three bids were received August 23, 1945, ranging from the contract low of $120,832 to $134,402.

LIST OF BIDDERS:

1. C. C. Moore Constr. Co., Inc., Panama City, Fla. (contract) — $120,832
2. Peacock Contracting Co., Panama City, Fla. — 133,929
3. Coggin & Deermont, Chipley, Fla. — 134,402

Item	Quan	Unit Prices (1)	(2)	(3)
1. Clearing and grubbing	22.59 ac.	$200.00	$120.00	$100.00
2. Regular excavation	10,536 c. y.	.45	.45	.50
3. Lateral ditch excavation	800 c. y.	.45	.80	.65
4. Subsoil excavation (A-8 mat'l.)	19,256 c. y.	.54	.40	.10
5. Remove exist. pavmt. (conc. pavmt. and conc. sidewalk)	933 s. y.	1.00	.20	.25
6. Hydraulic embankment	56,358 c. y.	.54	.60	.40
7. Overhaul	24,056 sta. c. y.	.01	.01	.01
8. Muck blanket	34,000 s. y.	.20	.15	.10
9. Sand bituminous road mix, 6-in.	21,632 s. y.	.26	.28	.24
10. Bituminous mat'l. (sand bitum. rd. mix, cut-back asphalt)	129,792 gal.	.10	.14	.13
11. Cem. conc. pavmt., rein., 9-in. thick	106 s. y.	7.00	6.00	6.00
12. Treated structural timber (wales 3x8-in.; and splice blks., 3x8-in.)	6.3 Mbm	250.00	250.00	200.00
13. Concrete, Cl. A., culverts	68.11 c. y.	40.00	45.00	42.00
14. Concrete, Cl. A., headwalls	5.30 c. y.	40.00	50.00	50.00
15. Reinforcing steel	5,666 lb.	.10	.07	.10
16. Conc. pipe culvert (15-in. cross drain)	117 l. f.	2.00	2.00	2.00
17. As above, 18-in. cross drain	78 l. f.	3.00	3.00	3.00
18. As above, 24-in. cross drain	71 l. f.	4.00	4.50	4.50
19. As above, 36-in. side drain	30 l. f.	6.00	5.50	7.00
20. Relay exist. side-drain pipe, 18-in. conc.	34 l. f.	3.00	1.50	3.00
21. As above, 24-in. conc.	24 l. f.	3.00	2.50	4.00
22. As above, 36-in. conc.	30 l. f.	4.00	3.00	4.50
23. 15-in. bitum. coated corr. metal pipe culvert	120 l. f.	3.00	2.40	3.75
24. Treated timber piling (bulkheads and anchors)	6,584 l. f.	1.70	2.50	3.10
25. Timber sheet piling (2x8-in. rough)	80.1 Mbm	175.00	250.00	250.00
26. Inlets, Type BR (4 to 6-ft. deep)	3 ea.	200.00	150.00	200.00
27. Inlets, Type BS (0 to 4-ft. deep)	4 ea.	200.00	150.00	150.00
28. Inlet, Type BMR (4 to 6-ft. deep)	1 ea.	300.00	175.00	225.00
29. Inlets, Type BV (0 to 4-ft. deep)	2 ea.	200.00	150.00	175.00
30. Manhole, Type A (6 to 8-ft. deep)	1 ea.	400.00	250.00	250.00
31. Concrete curb and gutter	3,709 l. f.	1.40	1.25	1.45
32. Concrete sidewalk, 4-in. thick	160 s. f.	.30	.35	.25
33. Concrete sidewalk, 42-in. thick	175 s. f.	.35	.40	.30
34. Sprigging	50,000 s. y.	.04	.05	.06
35. Hardware (tie bars, bolts, etc.)	9,240 lb.	.15	.18	.15

Flash — On every competitive test to date, LaPlant-Choate's new 8-yard cable-operated scraper has "run rings around" all other competitive scrapers tested. A limited number are already in the field, with everything set for economical mass production as soon as military conditions permit. You'll agree — it's a scraper well worth waiting for!

THOUSANDS OF SATISFIED OWNERS AGREE

It's LPC for LOWEST POSSIBLE COST

There are many good reasons why thousands of successful operators who have been using LaPlant-Choate rigs for years will keep right on buying them after the war. For one thing, these long-time users know from experience that LPC dozers and scrapers consistently move more yardage faster and at lower cost. They also know that LaPlant-Choate performance and dependability have been *job-proved around the world* under all types of conditions. And best of all, these veteran operators know that LaPlant-Choate will continue to lead the way in developing new improvements because LPC's entire organization is *strictly "tractor-equipment-minded"* . . . with more years of specialized "know-how" than any other company in the industry. So it all adds up to LPC—for lowest possible cost and better results—on your jobs, too. See your LPC-"Caterpillar" distributor today. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; San Leandro, California.

ARMY E NAVY

LAPLANT CHOATE

EARTHMOVING AND LAND CLEARING EQUIPMENT

THERE IS A JOB-PROVED LA PLANT-CHOATE RIG FOR EVERY EARTHMOVING AND LAND CLEARING NEED

ALL TYPES OF DOZERS — Straight or angling blade, hydraulic or cable operated, for every size of track-type tractor.

LARGE OR SMALL SCRAPERS — Hydraulic or cable operated, front or rear dump, for use with your wheel or track-type tractors.

CABLE OPERATED RIPPERS — For ripping up hard ground, shale or concrete to facilitate loading with LPC "Carrimor" Scrapers.

LAND CLEARING TOOLS — A complete line of Brush Cutters, Treedozers, Rootcutters and Brush Rakes—all are interchangeable.

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

CONSTRUCTION MATERIAL prices and labor rates reported in October to *Engineering News-Record* reveal only minor changes from the preceding month. Portland cement prices are up 10c. per barrel in Detroit and Pittsburgh. Ready-mixed concrete is 10c. higher in Detroit, and up 20c. per cu. yd. in Philadelphia. Concrete block increased in Pittsburgh. The cement mill price base is 10c. per barrel higher at Universal, Pa. Vitrified sewer pipe prices increased in St. Louis. Common brick is $2.00 per M higher in New York, but at the present time there is little brick available. Western Pine boards, 1-in. sizes, rose $1.00 per M ft. b.m., in Minneapolis. Douglas fir 1-in. boards, however, are $5.75 lower in Seattle.

In Birmingham the carpenters' rate, formerly $1.25 per hour, now ranges from $1.25 to $1.50. The structural ironworkers' rate in St. Louis rose from $1.75 per hour to $1.90. The Detroit plasterers' rate climbed 5c. per hour and now is $1.775. Common labor rates on both building and heavy construction are unchanged from a month ago.

CEMENT, AGGREGATE, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT (Per bbl., C/L lots, incl. 40c. per bbl. for bags, cash dis. not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE BLOCK 8x8x16-in. truckload del.; per block		CONCRETE Ready Mix 1:2:4 over
	Cloth *a*	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav.	Lt.wgt. Agg.	50 c.y., del
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.59	$1.69	$0.17	....	$8.20
Baltimore	2.62	2.37	2.12	1.80‡	1.80‡	1.30‡	1.80‡	1.80‡	1.75‡	1.75‡	.125	$0.125*w*	7.45
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	....	5.80
Boston	2.97*b*	2.72*b*	2.52	1.50‡	1.50‡	1.05‡	1.25‡	1.35‡	....	....	.13	.155*w*	7.55*n*
Chicago	2.90	2.65	2.50	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	.18	.18*x*	....
Cincinnati	2.41	2.16	1.96	1.20	1.20	1.10	1.80	1.80	....	....	.12	.15*w*	6.70
Cleveland	2.49	2.24	....	1.75*i*	1.75*i*	1.25/1.65*i*	1.80*i*	1.80*i*	1.15	1.15	.14	.14	7.45
Dallas	2.51	2.26	2.06	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	.15	....	7.10
Denver	3.32	2.72	2.47	1.20	1.30	1.25	1.65	1.75	1.00	1.00	....	.15	7.25
Detroit	2.59	2.34	2.19	1.50	1.50	1.30	2.25	2.25	2.00‡	2.00‡	.13	.14*w*	7.25
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	.125	.125*wy*	7.80
Los Angeles	3.20*v*	2.60*v*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	.04*bb*	.10*aa*	7.25
Minneapolis	3.07	2.82	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.14	....	7.55
Montreal	....	1.95*r*	1.79*r*	1.65‡*s*	1.65‡*s*	1.50*t*	.80*et*	.90*et*	....	....	.14*t*	.14*wt*	7.85*u*
New Orleans	2.41	2.16	1.92	1.67	1.65	1.22	....	....	.90	1.15	.19	....	9.25
New York	2.85‡	2.60‡	....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	....	....	.16	.14*wcc*	8.25*k*
Philadelphia	2.73	2.48	2.28	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	.155	.155*w*	8.55
Pittsburgh	2.80	2.55	2.35	1.65‡	1.65‡	1.85‡	2.25‡	2.25‡	1.50	1.50	.17	.17*s*	8.40
St. Louis	3.00	2.72	....	1.75‡	1.40‡	1.25/1.40‡	1.25*h*	1.25*h*	.90*g*	1.10*g*	.155	.135*w*	8.60
San Francisco	2.21	2.01	1.71	1.36	1.36	1.36	1.46	1.46	....	....	....	.21*y*	7.35
Seattle	....*u*	3.00*v*	....	2.35‡*d*	2.35‡*d*	2.35‡*d*	2.85‡*od*	2.85‡*od*	....	....	.16	.16*y*	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* Withdrawn. *v* 20c. per bbl. discount; 20c. allowed for returnable cloth bag. *w* Cinder. *x* Waylite. *z* Celocrete. *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* 8 x 18 x 18 in.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind	$1.90	$1.85	Ironton, Ohio	$1.80*	$1.75*	Richard City, Tenn	$1.80	$1.7
Dallas, Tex	....	....	Limedale, Ind	....	....	Steelton, Minn	2.00	1.8
Hannibal, Mo	1.90	1.85	Norfolk, Va	....	....	Universal, Pa	1.85	1.8
Hudson, N. Y	....	....	Northampton, Pa	1.75	1.70	Waco, Tex. (Plus 9c. tax in Tex.)	1.75	1.7
Independence, Kans	1.70	1.65	North Birmingham, Ala	....	....	Montreal City (Discount 10c. per bbl. 20 days)	1.68	1.6

*Destination price base; effective Sept., 17, 1945

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80–300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OIL (Per gal)	ASPHALT EMULSION (Quick-breaking) (Per gal)	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. 6d. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.53*e*	.....†	$0.0740*e*	.....†	$0.0806*he*	.....†	$0.0781*e*	$0.0806	.....
Baltimore	150.00‡	49.00	85.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.06*r*	.07*r*	.14*r*
Birmingham	150.00	32.00*j*	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.095	.....
Boston	85.00	59.00	3.75	15.00	24.00	.0625	.115	17.00	30.00	.0625	.0825	.145
Chicago	150.00	55.00	2.50/2.80*d*	14.00	22.50	13.00*g*	21.50*g*	.0575*h*	.15*h*	.05*n*	.09/.10*n*	.13/.15*n*
Cincinnati	120.00	53.75	.....	17.00	.....	.085	.....	12.25	.....	.07	.085	.....
Cleveland	120.00	30.00	3.57*l*	17.00	19.00	.085	.095	.10*h*	.11	.08	.10	.....
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07/.09
Denver	.....	16.11	.....	11.00	.....	10.00	.....	.045*h*	.....	.....	.....	.....
Detroit	.....	37.00	.....	18.06*f*	25.60*f*	.0734	.128	.0718*h*	.119*h*	.067	.0775	.116
Kansas City	.....	44.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	.....	9.00*b*	23.00	9.50*bg*	24.00*bg*	9.50*b*	.....	.025	.072	.15
Minneapolis	.....	.....	2.017*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	.....
Montreal	92.40	.....	.....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080	.....
New York	.....	65.00	.....	17.40	24.20*p*	14.00	.....	.0725*h*	.1325*hp*	.....	.0725*p*	.119
Philadelphia	140.00	58.00	4.06	15.00*r*	.....	14.00/15.00	.....	.0625*h*	.....	.....	14.00*gr*	.....
Pittsburgh	135.00	39.75	.....	18.00	23.00	.09	.16	20.00	36.00	.07	.06	.11
St. Louis	.....	39.00	.....	16.00	22.00	15.00*g*	21.00*g*	.0575*h*	.12125*h*	.648	.06	.11
San Francisco	.....	45.00	.....	10.90	21.15	10.90*g*	18.00*gr*	12.90	17.50*r*	9.50*gr*	.0525	.112
Seattle	.....	.....	.....	10.90*i*	21.90*i*	.....	20.40*gi*	11.40*i*	.....	10.90	.0525*h*	.062

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½ x 4 x 8½ in. *d* 2-in. interior block, 6-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3 x 3½ x 8½ in. *k* Tas included. *l* F.o.b. Toledo. *m* Per thousand. † Available on prior only and quoted specially. *p* No steel drum shipments except to armed for *r* February 1943 prices, none later available.

Here comes a blue star turned into a blue chip

THE sooner those boys step off your service flag (or someone else's) into your business, the sooner you're going to have a new lift, unlike anything you've had for years.

Employee training? They're the finished products of the greatest program of finding and developing skills this world ever saw.

Morale getting a little low around the place? A few of these lads with their eagerness to get back and get ahead will snap it up in a hurry.

Discipline a little lax? These boys are the essence of discipline at its best. And they'll *keep* it, because they know they could not coast on their war jobs—they must *progress* on their peace jobs.

There are men with practically every skill you could possibly want, *and we mean skill.* Those skills are good enough to lick the toughest job the world ever saw. Use them to help you lick the business problems ahead.

These men are blue chips.

Published in cooperation with the War Advertising Council with the gratitude and pride all Americans feel for our fighting men —by The B. F. Goodrich Company.

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES PLATE	REINF. BARS ¼-in. billet *b*	RIVETS ½-in structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton: Standard	Light	Re-rolled	TRACK SUPPLIES: Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.90	.....	$43.00	$45.00	$45.00*	$2.70	$3.25	$2.30	$4.75
Chicago	2.10	2.15	3.75	2.90	$2.40	43.00	45.00	45.00*	2.70	3.25	2.30	4.75
Pittsburgh	2.10	2.15	3.75	2.90	2.40	43.00	45.00	45.00*	2.70	3.25	2.30	4.75
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	....	....	2.30	....
Cleveland *g*	2.10	2.15	3.75	2.90	.....	.....	.....	.....	....	.....	....	....
Youngstown	....	2.15	.....	.....	.....	.....	.....	.....	....	3.25	....	....
Detroit	....	2.27‡	.....	.....	.....	.....	.....	.....	....	....	....	....
Gulf ports	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	....	....	....	....
Pacific ports	2.75*a*	2.80*a*	.....	3.40	2.95*a*	.....	.....	.....	....	....	....	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., on * Per net ton.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¼ in., base price: 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots: Std. diamond mesh, 3.4 lb.	Std ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires *k* Per 100 s. f.	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.40	$2.40	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$1.91	$3.04
Baltimore	3.70	2.90	2.75	....	.10	23.00	25.00	1.70	1.27	1.79	3.00
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.00	1.80	1.34	1.89	....
Boston	3.912	3.994	....	$20 C.L.	.10	18.50	29.50	1.76	1.31	1.84	2.77
Chicago	2.10*a*	2.15*a*	2.15*a*	.03	.05	21.50	23.50	1.67	1.25	1.75	2.40
Cincinnati	3.68	2.53*cd*	2.53*cd*	....	.05	19.50	21.50	1.66	1.25	1.74	....
Cleveland	3.588*k*	3.10*k*	3.10*k*	.02½	.10	20.50	22.50	1.66	1.25	1.74	....
Dallas	4.25	3.17	3.17	....	....	25.50	27.50	1.93	1.42	2.03	....
Denver	4.57	4.09	....	....	....	26.50	26.50	1.97	1.45	2.07	....
Detroit	3.661‡	2.50‡	2.50‡	....	.10	30.00	30.00	1.68	1.26	1.76	2.66
Kansas City	4.19	2.61*cd*	2.61*cd*	.0	.05	24.50	26.50	1.78	1.33	1.87	2.874
Los Angeles	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	2.03	3.65
Minneapolis	3.81‡	2.73	2.73	.0	.10	21.00	23.00	1.80	1.34	1.89	2.73*d*
Montreal	3.95*i*	2.90*i*	2.80*i*	....	....	31.00*hi*	46.60*hi*	2.76	3.44*i*	2.82*im*	....
New Orleans	4.158‡*k*	3.59*k*	....	.05	.10	23.50	22.00	1.82	1.35	1.91	2.875
New York	3.75	2.76*e*	2.76*e*	....	.15	17.50	19.50	1.76	1.32	1.81	2.74
Philadelphia	3.666	3.668	....	....	....	20.50	22.50	1.71	1.28	1.79	2.72
Pittsburgh	2.10*a*	2.15*a*	2.15*a*	.02½	.10	23.00	26.50	1.59	1.20	1.67	2.40
St. Louis	3.607	2.74	2.74	.0	.05	28.00	34.00	1.69	1.27	1.78	2.70
San Francisco	4.35	2.825	2.675	.02½	.10	21.00	2[illegible].50	1.93	1.42	2.03	3.70
Seattle	2.75*e*	2.80*e*	....	....	....	34.50	38.50	1.93	1.42	2.03	2.95*e*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *k* Quotation on changed basis; no actual price change. *m* Per sq. yd.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s	ASTM 24 in.	C13–35 36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in	C 14–35 24 in	WROUGHT STEEL PIPE Full standard weight, *h* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in.; Lap Weld Black %	Galv %
Atlanta	$50.66	$0.31*b*	$0.558*bc*	$3.082*c*	$5.70*c*	$110.00	$140.00	$0.45	$1.70	48.2	54.2	59.7	51.2
Baltimore	54.00	.35	.60	2.70	7.25	160.00	200.00	.65	1.90	65.5	57.5	63.0	54.5
Birmingham	46.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	51.2
Boston	56.40	.371*r*	.7155*r*	2.79*r*	7.6875*r*	170.00‡*r*	265.00‡*r*	.60	1.95	....	....	....	....
Chicago	55.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53.0
Cincinnati	54.27	.231	.4455	1.80	5.125	105.00‡*s*	170.00‡*s*	.75*t*	1.75*t*	57.1	43.4	54.0	39.6
Cleveland	55.75	.266*r*	.513	2.15	5.535	90.60	139.40	.36	1.40	68.5	57.5	66.0	54.5
Dallas	57.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	....	....	....	....
Denver	62.56	.32‡	.576‡	2.376‡	.....	143.00‡	264.00†	1.00†	2.05†	58.4	50.4	55.7	47.2
Detroit	55.75	.385	.7425	2.925	7.75	170.00‡*u*	263.00‡*u*	.36	1.75	57.6	44.0	54.5	40.2
Kansas City	56.73	.35	.59	2.20	6.20	160.00	300.00	.45	1.60	35.6	46.1	46.2	59.4
Los Angeles	69.40	.325†	.585†	2.70†	6.75†	130.50	217.50	1.00	2.00	61.1	50.1	58.6	47.1
Minneapolis	60.10	.305†	.549†	2.196†	6.25†	.....	.....	.90	2.10	64.2	53.2	60.7	49.2
Montreal	67.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.811*m*	2.31*m*	....	....	....	....
New Orleans	52.78	.37*r*	.78	1.69	.....	150.00	220.00	.45	1.65	62.4	54.4	58.8	50.3
New York	53.40	.35	.675	2.835	7.35	.....	.....	.60	1.40	64.9	53.9	62.4	50.9
Philadelphia	52.00	.35	.675	2.835	7.35	165.00	225.00	.45	1.75	56.6	42.8	53.6	39.1
Pittsburgh	57.00	.266†	.513†	2.295†	5.945	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5*i*
St Louis	55.62	.31	.558	2.232	4.95	93.50	242.00	1.00*j*	2.10*k*	56.4	42.6	52.5	38.4
San Francisco	69.40	.3625*d*	.6525*d*	2.61	6.52	115.00	192.50	.58	2.34	45.0	31.0	41.0	26.0
Seattle	71.20	.40	.72	2.83	....	115.20	.....	.51*f*	1.44*f*	....	....	....	....

‡ Delivered. †F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N. J. (base) $50.00. Based on existing freight rates; subject to rate change. Gas pipe and class A. $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.; ¼ in., 8½c.; ⅜ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 per cent tax on transportation costs not included. *i* Applies also at Lorain, Ohio mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh. Lorain, O., Chicago Dist., Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt-weld—1 in. and 1¼ in. black 34 galv. 16; 1½ in. black 38 galv. 18; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½ gal. 14½; 4½ in. to 8 in black, 32½ galv. 17. Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Centri. spun. *n* 27-in. pipe. *o* Less 50%. *p* Less 53%. *s* Price quotations on delivered basis since Mar. 1940; current f.o.b. price $84 for 6 in.; $130 for 8 in. *t* Reinforced pipe prices since May 1937; current plain pipe prices are: 12 in., 36c.; 24 in. $1.50. *u* Scarce: carload quantities not readily available.

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)												
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	¾"	¾"
Atlanta	**$41.00**	**$41.00**	**$35.50**	**$38.50**	**$37.50**	**$41.50**	**$45.00**	.....	.....	$60.50	$64.00	$17.90	$21.85
Baltimore	**44.00**	**46.00**	**44.00**	**46.00**	**47.00**	**52.00**	**65.00**	.....	.....	115.00	120.00	18.25	22.25
	48.00	*49.00*	*55.00*	*55.00*	*55.00*	*57.50*	*68.00*	*$75.00*	*$75.00*	.....	.....	.....	.....
Birmingham	**45.00**	**45.00**	**44.50**	**43.50**	**44.50**	**47.50**	**68.00**	**55.00**	**56.00**	.....	.....	17.35	21.15
[1]	50.00	50.00	49.50	48.50	49.50	52.50	72.00	.....	.....	67.50	70.00	.....	.....
Boston	60.00[2]	60.00[2]	60.00[2]	60.00[2]	60.00[2]	62.00[2]	66.00[2]	.....	.....	58.00[2]	58.00	18.25	22.25
	55.00	*55.00*	*54.00*	*54.00*	*54.00*	*54.00*	*58.00*	*58.00*	*58.00*	.....	.....	.....	.....
Chicago	**55.00**	**55.00**	**58.50**	**54.00**	**54.00**	**60.00**	**68.00**	.....	.....	80.00*l*	95.00*l*	14.60	17.80
	55.00	*55.00*	*54.00*	*54.00*	*54.00*	*55.00*	*56.00*	*57.00*	.....	.....	.....	.....	.....
Cincinnati	**47.50**	**49.00**	**42.50**	**42.50**	**42.50**	**44.50**	**67.00**	.....	.....	65.00	65.00	17.35	21.15
Cleveland	**42.50***k*	**42.50***k*	**52.50***k*	**51.00***k*	**65.00**	**65.00**	**83.00**	**83.00**	**83.00**	.....	.....	17.75	21.60
Dallas	**45.25**	**45.25**	**44.50**	**43.00**	**43.00**	**47.25**	**60.75**	**58.75**	**58.75**	88.75	85.00	14.60	17.80
Denver ‡	68.00[4]	68.00[4]	64.75[4]	65.25[4]	63.75[4]	64.75[4]	68.75[4]	*72.00*	*72.25*	.....	.....	10.45	12.70
Detroit	**61.00**	**61.00**	**57.75**	**57.75**	**57.75**	**63.75**	**71.00**	.....	.....	70.75	90.00	17.35	21.15
	57.00	*57.00*	*57.00*	*57.00*	*62.75*	*72.75*	*75.00*	*75.00*	*90.00*	.....	.....	.....	.....
Kansas City	**69.00**	**69.00**	**67.00**	**65.50**	**67.00**	**69.00**	**84.00**	.....	.....	84.00	94.00	12.60	15.40
	66.00	*66.00*	*59.50*	*59.50*	*59.50*	*59.50*	*75.00*	*80.00*	*80.00*	.....	.....	.....	.....
Los Angeles	*60.00*	*60.00*	*60.50*	*60.75*	*59.25*	*59.25*	*72.75*	*72.00*	*72.00*	.....	.....	9.90*gh*	12.05*gh*
Minneapolis	63.00[3]	62.00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60	15.40
‡	*69.00*	*69.00*	*60.00*	*61.00*	*59.00*	*60.00*	*61.00*	*65.00*	*65.00*	.....	.....	.....	.....
Montreal †	*64.00*	*65.00*	*60.00*	*63.00*	*61.00*	*70.00*	.....	.....	.....	200.00	200.00	.....	.....
	90.00	*90.00*	*90.00*	*90.00*	*90.00*	*90.00*	*80.00*	*80.00*	*80.00*	.....	.....	.....	.....
New Orleans	**41.00**	**39.50**	**37.00**	**35.00**	**34.00**	**36.00**	**46.00**	.....	.....	55.00	69.00	14.60	17.80
	30.50	*30.50*	*30.00*	*30.00*	*29.00*	*29.00*	*28.50*	*29.50*	*29.50*	.....	.....	.....	.....
New York	**67.50**	**67.50**	**62.50**	**62.50**	**62.50**	**64.00**	**74.00**	.....	.....	120.00*f*	125.00*f*	18.35	22.25
‡	.....	.....	*65.00i*	*65.00i*	*65.00i*	*65.00i*	[Range from $75 to $95]			.....	.....	.....	.....
Philadelphia	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	.....	.....	130.00	130.00	18.25	22.25
	75.00	*75.00*	*75.00*	*75.00*	*75.00*	*75.00*	*85.00*	*90.00*	*90.00*	.....	.....	.....	.....
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	.....	.....	.....	.....	18.10	22.05
	69.20	*68.10*	*66.10*	*65.30*	*65.20*	*65.65*	*82.75*	*88.75*	*88.75*	.....	.....	.....	.....
St. Louis ‡	**61.00**	**61.00**	**57.00**	**56.00**	**57.00**	**59.00**	**71.00**	*75.00*	*75.00*	87.00	87.00	14.60	17.80
San Francisco	*41.00*	*41.00*	*36.50*	*36.75*	*35.75*	*35.75*	*37.50*	*36.00*	*36.00*	.....	.....	7.30*g*	8.90*g*
Seattle	*45.50*	*45.50*	*45.75*	*45.75*	*44.50*	*44.50*	*47.75*	*47.75*	*46.50*	.....	.....	0.00	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¾", $95.15; on ¾", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $75. *j* Average price. *k* August 1943 price. *l* September price; none later available.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	74%	75%	$0.15	
Baltimore	78%	79%	.15	
Birmingham	76%	76%	.105	
Boston	77%	78%	.15	
Chicago	77%	77%	.15	
Cincinnati	77–10%	77–10%	.15	Price of 60% Ammonia Gelatin in $0.01 per lb higher than 40%
Cleveland	77%	77%	.19	
Dallas	76%	76%	.1625	
Denver	76%	76%	.155*c*	
Detroit	77%	77%	.1575	
Kansas City	77–10%	77–10%	.155	
Los Angeles	86%*d*	88%*d*	.1575	
Minneapolis	77%	77%	.155	
Montreal	40–10–2%*ab*	50–2%*ac*	.1675†	
New Orleans	70%	75%	.16	
New York	81%	82%	.22*f*	
Philadelphia	78%	79%	.15	
Pittsburgh	79%	79%	.1225	
St. Louis	77–10%	77–10%	.155	
San Francisco	66%	73%	.155	
Seattle	75%	75%	.1575†	

a Discount from list Sept. 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal St. add delivery charge of $6.00 per trip. † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES TIES— F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	By Rail — Fir
12-in. at butt	6-in	30 to 50-ft	$0.34	.....
12 in.— 2 ft. from butt	6-in.	50 to 59-ft.	.35	.....
12-in.— 2 ft. from butt	6-in.	60 to 69-ft.	.36	.....
12-in.— 2 ft. from butt	6-in.	90 to 100-ft	....	.5575
13-in.— 3-ft. from butt	5-in.	91 to 100-ft	....	.5608
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.41	.6175
14-in.— 2-ft. from butt	6-in.	70 to 79-ft	.43	.59
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.54	.....
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	.57	.....
14-in.— 2-ft. from butt	5-in.	90 to 100-ft	....	.60

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	.....	$2.00	.....
	Pine	2.00	$3.00*a*	2.50	$3.00*a*
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	White Oak	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.45/2.65*a*	....	3.35/3.60
Los Angeles	Douglas Fir	2.00	3.25*a*	2.90	4.70*a*
Philadelphia	Red Oak	....	2.10*ag*	....	3.25*ag*
St. Louis	White Oak	1.60	....	2.19	....
	Red Oak	1.63	2.15*a*	2.19	3.25*a*
	Sap Pine or Cypress	1.70	....	2.06	....
San Francisco	Douglas Fir	1.25*bef*	....	....	3.00*eaf*
Montreal	Birch or Maple	....	1.65	1.04	....

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 price, none later available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.50– 3.10
Chlorine cylinders, liquid, per lb., delivered	.0525
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	18.50–35.00
Silicate of soda, 52 deg. in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00–25.00
Sulphate of copper, in bbl., per 100-lb	5.00

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE — PARTITION — SCORED			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED			BRICK		LIME		
	Per M lots of 2,000 pieces or over,			Per M lots of 2,000 pieces or over,			Per M in quantity		Per ton,	In paper,	Carload lots, Paper-sacked,
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$18.25	$20.04	$26.54	$15.04	$15.04
Baltimore	84.00	90.00	170.00	200.00	260.00	300.00	17.00*k*	21.00*k*	19.00	14.00	2.50*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	16.50	23.00	18.11	13.64	2.25*b*
Boston	103.75*a*	110.65*a*	207.45*a*	248.90	.....	.....	20.00*i*	20.00*i*	21.00†	.....	16.00
Chicago	79.50	85.00	160.00	197.00	243.00	278.00	15.00	16.00	17.00	15.00	12.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	25.75	25.75	15.50	13.00	.....
Cleveland	82.50	97.35	182.50	.....	.....	.....	20.75	20.00	15.75	13.25	.....
Dallas	71.40	76.40	145.30	183.50	238.00	294.50	15.25*i*	16.75*i*	19.00	15.00	15.00
Denver	91.20	102.60	165.30	189.80	228.00	262.20	19.50	18.00	25.00*j*	17.00*j*	20.00*j*
Detroit	92.70	96.70	174.50	198.80	257.20	294.30	20.50	20.50	18.00	16.00	16.00
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	17.50	18.50	19.32	13.00	10.92
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	17.50
Minneapolis	87.00*b*	92.80*b*	157.30*b*	.....	189.00*b*	262.00*b*	25.50	31.50*g*	21.00	16.00	19.00
Montreal	92.50*a*	98.50*a*	196.25*a*	151.50*a*	100.50*at*	134.50*a*v	22.16†*u*	33.20†*u*	24.60*u*	15.00*u*	14.00*u*
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	90.80	96.80	133.10*c*	219.80*h*	269.80*h*	333.90*h*	19.50/20.50	.....	20.00	14.00	17.00
Philadelphia	104.20	111.20	208.40	250.10	305.10	377.70	18.75	21.75	19.00	16.00	15.00
Pittsburgh	74.20	79.15	148.40	233.00	284.00	325.00	21.25	23.25	17.90	15.40	2.55*m*
St. Louis	67.00	72.00	130.00	190.00	244.00	290.00†	20.50	19.50	22.00	18.00	2.50*m*
San Francisco	96.00	108.00	144.00	108.00*t*	.....	.....	21.50	.....	24.00	23.00	2.50*m*
Seattle	115.00	125.00	230.00	.....	.....	.....	20.50*f*	24.00*f*	20.00*s*	20.00*s*	20.00*s*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in., 3-cell. *d* Not load bearing. *e* 48 lb. tile. *g* Selected common. *h* F.o.b. Per h Amboy, N. J. *i* F.o.b. Warehouse only. *f* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 days. *s* 2% discount for cash. *t* 5½x8x12. *u* 8% sales tax included. *v* 6x12x12-in. *w* Per 200 lb. bag.

PAINT, ROOFING—F.O.B. CARLOAD LOTS

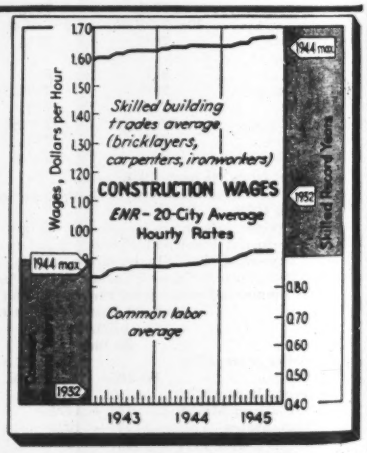
	RED LEAD	WHITE LEAD	READY-MIXED PAINT			ROOFING SUPPLIES		Carload lots f.o.b. factory		
	Per 100 lb. in 600-lb. (Approx.) bbl Dry *a*	Per 100 lb. in oil	Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.85	$1.72	$1.72	$0.305	$27.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2 09	1.98	1.98	.32	28.35
Boston	10.00	13.75	1.75	2.50	2.31	2 00‡*h*	3.30‡*u*v	3.30‡*u*v	.25‡	21.00‡
Chicago	10.00	13.75	....	....	....	1.75*hf*	1.74*hf*	1.82*hf*	.33*f*	23.00*f*
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.20	2.10*h*	2.10*h*	.33	25.00
Cleveland	10.00	13.75	1.70	2.90	1.60	1.71	1.63*h*	1.63*h*	.257	25.00
Dallas	10.00	14.50	1.88	2.11*n*	.05*l*	1.75*h*	1.66*h*	1.66*h*	.35	39.00
Denver	10.00	14.25	....	....	.27*l*	2.45	2.95	2.95	.35	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	10.00	13.875	2.30*g*	2.55*gr*	2.16*g*	2.19	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.7123*i*	1.6243*hi*	1.6243*hi*	.32	23.00
Montreal	.....	11.05	2.50*p*	4.90*p*	3.15*p*	4.02*t*	2.58*t*	3.01*t*	.89*t*	2.10*lt*
New York	10.00	13.75	2.03	....*r*	1.82	1.7098	1.6273*a*	1.6273*a*	.26	23.00
Philadelphia	10.00	13.75	1.60/1.80	2.20*r*	1.55	2.25	2.71	2.71	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.84*h*	1.84*h*	.34	26.00
St. Louis	10.00	13.75	2.28*s*	2.89*s*	1.96*s*	1.75	1.66	1.66	.33	24.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.35	1.71	2.40	2.40	.33	20.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	26.50*j*

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3–49A. *c* ASTM Spec. D266–31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 lb. *l* Per lb. *m* Per bbl. *n* May, 1941 price. *o* 60-lb. roll. *p* Plus 8% sales tax. *r* Not available, except on priority rating; then quoted specially. *s* December, 1942 price. *t* Federal tax included. *u* 90-lb. roll. *v* Truck delivery.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Brick-layers	Car-penters	Struct. Iron Workers	Hoisting Engineers	Plas-terers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$1.50	$1.25	$1.50	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.4375	1.80	1.625/1.80	1.725	.80	.80
Birmingham	1.75	1.25/1.50	1.625	1.375 /1.625	1.65	.65	.65
Boston	1.625	1.50	1.675	1.50 /1.875	1.667	1.00	1.00
Chicago	1.90	1.85	1.85	1.85	1.85	1.20	1.20
Cincinnati	1.825	1.60	1.725	1.45 /1.60	1.75	.90	.90
Cleveland	1.875*c*	1.575	1.875	1.875	1.875	1.085	1.125/1.155
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75 /1.25
Denver	1.80*b*	1.50*b*	1.50*b*	1.50 /1.625*b*	1.55	.825*b*	.825*b*
Detroit	1.725	1.50	1.825	1.675/1.825	1.775	1.00	1.00
Kansas City	1.75	1.575	1.70	1.675	1.75	.975	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.625	1.44	1.625	1.50	1.625	.95	.95
New Orleans	1.625	1.375	1.625	1.55	1.50	.70	.80
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*b*	1.10	1.10
Philadelphia	2.00	1.58	1.90/2.00	2.25	2.00	.90	.90
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	1.00	.90
St. Louis	1.90	1.70	1.90	2.00	1.75	1.00	1.00
San Francisco	1.875	1.50	1.75	1.50/1.75	1.75	1.00	1.00
Seattle	1.845	1.545	1.745	2.00	1.845	1.145	1.145
Montreal*	1.05	.96	1.01	.91	1.06	.61	.66

b 7 hr. day. *c* Prevailing rate on government work.
* Cost of living bonus now included in basic wage.

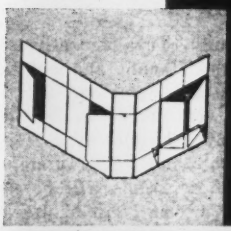


ENR Skilled Average; (Bricklayers, Carpenters, Ironworkers) $1.674.
ENR Common Average; $0.917.

HATS OFF DEPARTMENT

HATS OFF TO . . .
Emery Roth, Architect
Henry Rudin, Builder
for "925 Central Park West" Building
New York, N. Y.

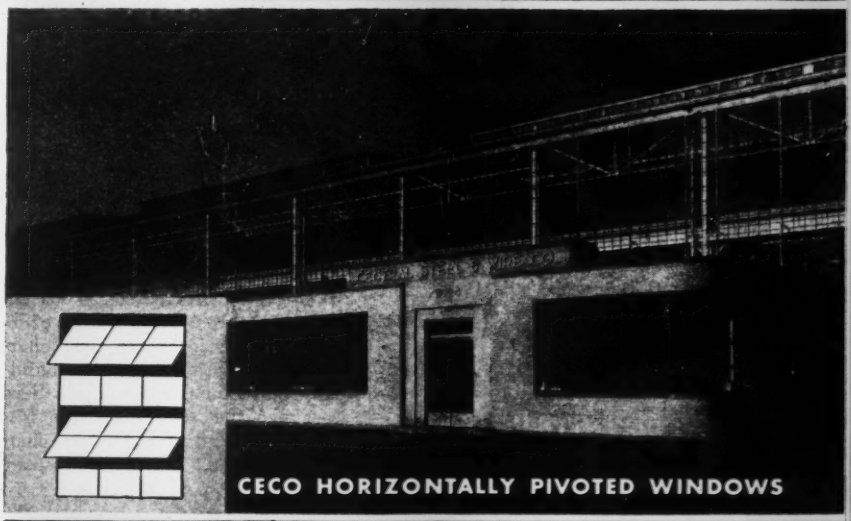
Here distinctive corner windows are formed by combining standard types of Ceco Apartment Windows through the use of vertical mullions. Prime purpose: maximum light and ventilation. Note also the use of inswing ventilators at the sills affording controlled ventilation for this modern apartment building.



CECO APARTMENT WINDOWS

HATS OFF TO . . .
Alfred S. Alschuler and R. N. Friedman
Architects and Builders
for Central Steel & Wire Company Building
Chicago, Illinois

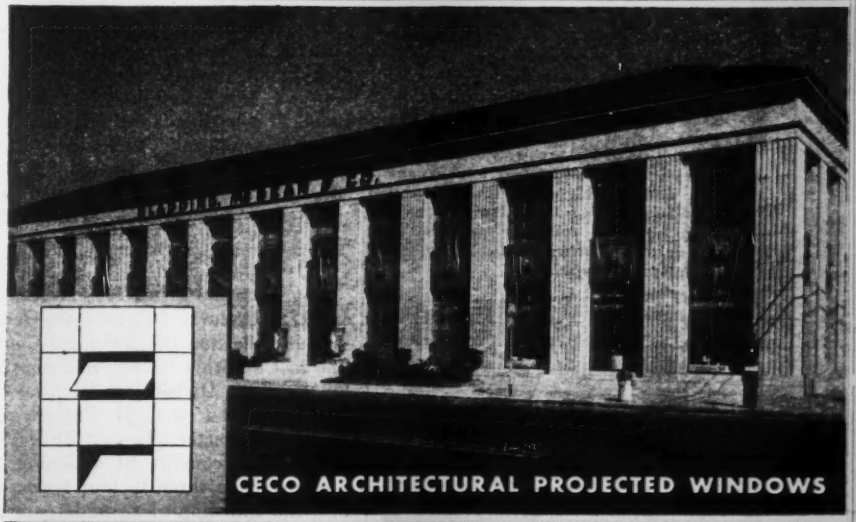
The architects were charged with obtaining maximum light for this modern factory. By using standard Ceco Horizontally Pivoted and Stationary Sash, continuous bands of windows were provided in the sidewalls and monitors. Result: Effective design and full use of outside light.



CECO HORIZONTALLY PIVOTED WINDOWS

HATS OFF TO . . .
Design Section of
Gladding McBean & Co.
Winniddie Construction Co.,
Contractor for Gladding McBean & Co.
San Francisco, Calif.

The use of Architectural Projected Windows in single unit openings provides effective symmetry and depth in this well-balanced and attractively designed office building. Inswinging ventilators at the sill and outswinging ventilators in the upper section give controlled ventilation with better light.



CECO ARCHITECTURAL PROJECTED WINDOWS

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Wherever fuel, water or air must be carried in pipes on construction projects, lines can be speedily laid with Rolagrip Pipe Couplings. Anchoring lines is unnecessary, no threads or grooves are required—just plain end pipe—and it can be light-walled. Flexibility in Rolagrips automatically takes care of contraction and expansion and provides for vibration and considerable angular misalignment. Both pipe and couplings are readily salvaged for other jobs. Write for complete information.

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BRIEF NEWS

Mexico's building construction boom, which has been going strong for five years, is giving no signs of abating, despite soaring costs of material and labor. Leading constructors believe the activity will continue for another five years at its present rate. Public works are being pushed all over the country, and government officials promise to continue them. There have been some shortages of material, but nothing critical contractors say, and labor is plentiful.

Harris County, Tex., recently sold $150,000 worth of bonds at the lowest interest rates ever obtained by the county. They were sold to the Northern Trust Company, Chicago, at a .9 percent interest rate and a $252 premium. Funds from these bonds will be used to pay the engineering cost of drawing the plans for the two tunnels that are to be built under the Houston Ship Channel.

The $1,500,000 navigation district bonds were sold to a syndicate headed by Lee Higginson Corp., Chicago at a 1.2 percent interest rate and a premium of $6,510. Funds from these bonds will be used to buy city facilities and improve the port at Houston.

Machinery is being assembled at Sowell's Bluff bridge, a $250,000 structure on the Red River north of Bonham, Tex., to force the river channel back under the bridge and to build an approach on the Oklahoma side. Several years ago the river made the bridge useless when it changed its channel and ran around the bridge instead of under it.

Connecticut Highway Commissioner William J. Cox has released plans for 13½ mi. of express highway in the Hartford and New Britain areas. This plan, aimed to meet increased postwar traffic demands and relieve existing traffic jams, will cost an estimated $21,700,000. Hartford will be girdled and spanned by a two-branch elevated highway.

Improvements to an 11½-mi. stretch of U. S. Highway 101 between Oceanside and the San Diego-Orange County line in California have been authorized by the State Division of Highways, it was announced by C. H. Purcell, public works director. To cost $1,341,000. the project consists of widening the highway from three to four lanes, and also the widening of an underpass and bridge.

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Stockton—Thompson-Sage, Inc.
Salinas—Farmers Mercantile Co.
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DEL.... Phillips Machinery & Tractor Co., Baltimore
FLA.... Jacksonville, Miami, Tampa—Florida Equipment Co.
Pensacola—Ray-Brooks Truck & Tractor Company
GA.... Atlanta—Tri-State, Inc.
Albany—Tri-State Tractor Company
IDA.... Boise & Pocatello—Intermountain Equipment Co.
ILL.... Peoria & Springfield—A. E. Hudson Company
Salem—E. W. Werner Motor Company
Chicago—Great Lakes Supply Corp.
IND.... Indianapolis—Indiana Equipment Co., Inc.
IOWA... Des Moines—Herman M. Brown Company
KANS... Wichita—S. H. Denney Road Machinery Co.
KY.... Louisville—Brandeis Machinery & Supply Co.
LA.... Baton Rouge & Monroe—Dunham-Pugh Co.
MAINE . Portland—Maine Truck-Tractor Co.
MD.... Baltimore—Phillips Machinery & Tractor Co.
MASS... Newton Highlands—Tractors, Inc.
MICH... Bark River—Bark River Culvert & Equipment Co.
Detroit and Grand Rapids—
Wolverine Tractor & Equipment Co.
MINN... Minneapolis & Duluth—Roshclt Equipment Co.
MISS.... Jackson—Mississippi Road Supply Co.
MO.... St. Louis—Missouri-Illinois Tractor & Equip. Co.
Kansas City—Noel V. Wood, Inc.
MONT.. Billings & Missoula—Industrial Equipment Co.
NEB.... Omaha—Nebraska Tractor & Equipment Company
North Platte—Cornhusker Tractor & Equip. Co.
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N. H.... Manchester—R. C. Hazelton Co.
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State Equipment Co.
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UTAH... Salt Lake City—The Lang Company
VA.... Richmond—Municipal Sales Company
Richmond and Roanoke—Rish Equipment Co.
Alexandria—Phillips Mach. & Tractor Co.
WASH.. Seattle—Howard-Cooper Corp.
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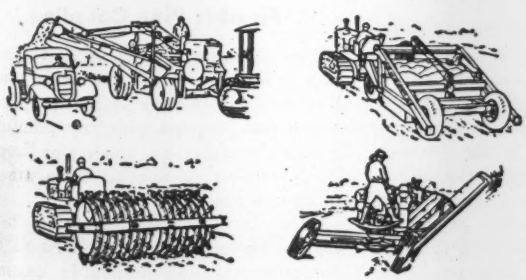

Adams

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Suspended Heater

Designed especially for suspension from walls or roof trusses, a new heat producing and distributing unit burns either gas or oil. Warm air can be discharged in any direction by regulating the nozzles, which have directional louvres to channel the flow up or down. As the hot air is driven from the nozzles at 1,800 to 2,000 ft. per minute, the heater works efficiently from as high as 30 ft. above the floor.

Depending on the size of the heater, B.t.u. output per hour capacities range from 300,000 to 1,650,000. Combustion takes place in a tear-drop shaped chamber, the lower half of which is lined with plastic refractory; air to be heated contacts the heating elements four times.—*Dravo Corp., Pittsburgh, 22, Pa.*

• • •

Mortar Cement

Maximum water retention, excellent workability, durability, high strength and permanent bond are combined with high sand-carrying capacity and pleasing color in the new Huron mortar cement, the manufacturer claims. Years of tests and research preceded release of this product.—*Huron Portland Cement Co.*

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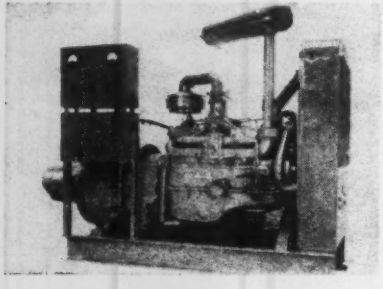

Generator

Useful on construction work, a new Model 52MPK6 generator is available for continuous duty or for stand-by service in case of power line failure. This model, 15,000 watts, 120/208 volts, A-C, 60 cycle, 3 phase, 4 wire, 1,200 rpm., revolving field type, is powered by a T-118 Chrysler 6-cylinder, 4-cycle watercooled engine.

The unit, which can be furnished with weatherproof housing if desired, is 70x 49½x24⅜ in., and is available for D-C or special voltages at a slight additional charge.—*Kato Engineering Co., Mankato, Minn.*

• • •

Rubber-Mounted Unit

Rated as a ½ yd. shovel, with quickly convertible front-end attachments for a complete range of construction, excavating and materials handling jobs, a new Type 10, Model 105 machine is said to be exceptionally mobile. It is optionally equipped with either four or six 10.00 x 20 tires, or with 14.00 x 20 rib tread tires for "off the road" service. Featuring air booster steering, the new rig can attain highway cruising speeds of more than 20 mph., it is claimed, and as it conforms to major highway regulations, it needs no permit in most states to travel over the roads.

This unit has optional 4-wheel drive; 4 speeds forward and reverse; accessible independent assemblies; self-counterweighing machinery.—*The General Excavator Co., Marion, Ohio.*

• • •

Pulsation Damping Unit

No moving parts are contained in the new Taylor damping unit for controlling pressure waves, nor is external adjustment necessary. This device consists of a series of alternate small capacities or volumes and orifices. As the pressure wave enters, a differential occurs across the first orifice, causing a flow through it and raising the pressure in the adjacent chamber. This in turn causes a flow through the next orifice, producing similar effects except with decreased intensity. While this "above-average" value of the pressure wave is making its way through the series of chambers, the pressure drops below the average value (since it is a pulsating one) causing a reversal of the flow process.

Fine mesh screens at entrance and exit overcome plugging, and a rod passing axially through the orifices can be removed for cleaning. The leak-proof unit is subjected to a static pressure test of 3,000 psi. and has a working pressure rating of 1,500 psi.—*Taylor Instrument Companies, Rochester, N. Y.*

• • •

Machinist's Vise

A new speed vise can be quickly set and closed, it is claimed, by simply pushing on body of the free jaw, which slides in quickly on a ratchet screw and two precision guide rods. The vise, equipped with a trigger release pawl with ¾ in. of thread which holds the hardened screw under spring tension, opens to full 3 in.

This Quikcet vise is made of alloy steel, with reinforced extra thick walls; it has a balanced precision grip at all points. It is spatterproofed for welding use with copper plating on all working parts and handles, and rustproofed with gray wrinkle enamel finish.—*Grand Specialties Co., Grand Ave. at Troy, Chicago 22, Ill.*

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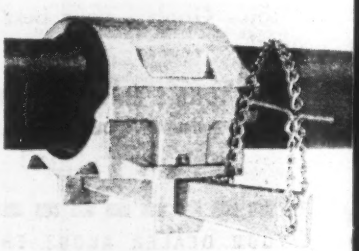
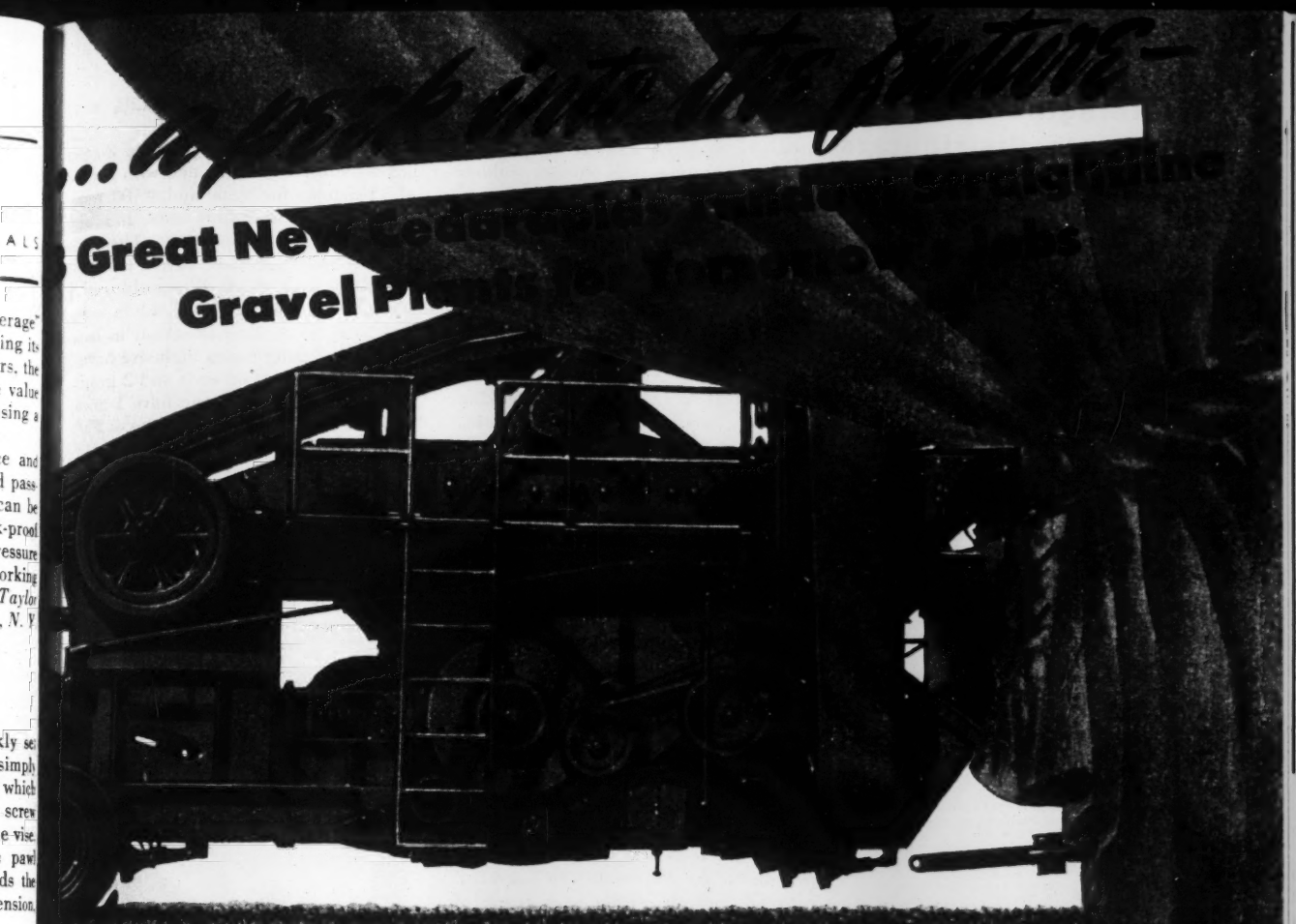


Flexible Pipe Coupling

Fast, flexible and inexpensive coupling is said to be possible with a new line of Presto-Lock pipe couplings which can be used with any plain end pipe without threads, grooves or flanges. No wrenches or special tools are required in assembly.

Made in eleven sizes from 1¼ to 6 inches, these couplings consist of two corrosion-resistant malleable castings

(*Continued on p.* 142)



...a great new Cedarapids Gravel Plant

for BIG Jobs—*The Master*
MEDIUM Jobs—*The Junior*
SMALL Jobs—*The Baby*

THREE new Cedarapids plants, differing only in size, will be ready for work on your 1946 contracts. Engineered and job-tested to rigid Cedarapids performance and economy standards, they will give you the production margin to make low-bid contracts show a good profit.

Check These Cedarapids Features:

Complete Single-Unit Portability. Fast set-up and take-down. On contractor's job tests, less than one-half hour to put the Junior Tandem into profit-making production!

Balanced High Capacities. Careful synchronization of conveyor speeds with screening, roll and jaw crusher capacities assures smooth, continuous operation at top efficiency.

Adaptability. Readily adaptable to any job conditions. Easy to convert into a complete Cedarapids Unitized Plant with primary crusher and washing and screening plant.

Extra Belt, Screen and Crusher Capacities for the tough jobs and hard-to-work materials.

Centralized Control. One man on control platform handles production.

Uniform Aggregate. Straightline Tandem design simplifies processing, insures aggregate to meet exacting specifications.

Low Maintenance. Rugged Cedarapids construction and easy access for greasing and adjustments keep maintenance costs at a minimum.

See your nearby Iowa distributor for complete details on these new Cedarapids Tandem Straightline Plants, or write direct.

IOWA MANUFACTURING COMPANY

Cedar Rapids, Iowa

Cedarapids

Built by IOWA

THE IOWA LINE

of Material Handling Equipment Includes

ROCK AND GRAVEL CRUSHERS
BELT CONVEYORS—STEEL BINS
BUCKET ELEVATORS
VIBRATOR AND REVOLVING SCREENS
STRAIGHT LINE ROCK AND GRAVEL PLANTS
FEEDERS — TRAPS
PORTABLE POWER CONVEYORS
PORTABLE STONE PLANTS
PORTABLE GRAVEL PLANTS
REDUCTION CRUSHERS
BATCH TYPE ASPHALT PLANTS
TRAVELING (ROAD MIX) PLANTS
DRAG SCRAPER TANKS
WASHING PLANTS
TRACTOR-CRUSHER PLANTS
STEEL TRUCKS AND TRAILERS
KUBIT IMPACT BREAKERS

Worthington-Ransome Blue Brute Distributors

By referring to the advertisement on page 143, you'll learn the meaning of the (1), (2) or (1-2) beside their names.

Ala., Birmingham (1) J. D. Pittman Tractor Co.
Ariz., Phoenix (2) Smith Booth Usher Co.
Ark., Fort Smith (2) R. A. Young & Son
Little Rock (1) Kern-Limerick, Inc.
Little Rock (2) R. A. Young & Son
Calif., Los Angeles (1) Garlinghouse Bros.
Los Angeles (1-2) Smith Booth Usher Co.
San Francisco (2) Coast Equipment Co.
Colo., Denver (2) John N. Meade
Denver (1-2) Power Equipment Co.
Conn., Hartford (2) The Holmes-Talcott Co.
New Haven (1) W. I. Clark
Waterbury (1) Contractors Supply Co.
D. C. Washington (1) M. A. Doetsch Machinery Co.
Fla., Miami (1-2) Allied Equip., Inc.
Tampa (2) S. M. Regar
Ga., Atlanta (1-2) Tractor & Machinery Co.
Savannah (1) Morgans, Inc.
Ida., Boise (1-2) Olson Manufacturing Co.
Ill., Chicago (1-2) Chicago Construction Equipment Co.
Chicago (2) John A. Roche
Chicago (1) Thomas Hoist Co.
Ind., Fort Wayne (1) American Steel Supply Co.
Indianapolis (2) Reid-Holcomb Co.
Iowa, Des Moines (2) Electric Eng. & Const. Co.
Ky., Harlan (2) Hall Equipment Sales Co.
Louisville (2) T. C. Coleman & Son
Louisville (2) Williams Tractor Co.
Paducah (1) Henry A. Petter Supply Co.
La., New Orleans (1) Ole K. Olson Co.
New Orleans (2) Wm. F. Surgi Equipment Co.
Maine, Portland (1-2) Maine Truck-Tractor Co.
Md., Baltimore (1) Stuart M. Christhilf & Co.
Baltimore (2) D. C. Elphinstone, Inc.
Mass., Boston, Allston (1-2) Clark-Wilcox Co.
Cambridge (2) W. W. Field & Son, Inc.
Mich., Detroit (1) T. G. Abrams
Detroit (2) W. H. Anderson Co., Inc.
Dearborn (2) T. G. Abrams
Flint (2) Gransden-Hall & Co.
Muskegon (1-2) Lakeshore Machinery & Supply Co.
Minn., Minneapolis (1-2) Phillippi-Murphy Equipt. Co.
St. Paul (2) D. L. O'Brien
Miss., Jackson (1) Jackson Road Equipment Co.
Mo., Clayton (1-2) The Howard Corporation
Kansas City (1) Brown-Strauss Corp.
Kansas City (2) Machinery & Supplies Co.
St. Louis (2) W. H. Reaves
Neb., Lincoln (1) Highway Equipment & Supply Co.
N. J., Hillside (2) P. A. Drobach
Newark (1) Johnson & Doalaman
North Bergen (2) American Air Compressor Corp.
N. M., Albuquerque (2) Bud Fisher Co.
Roswell (2) Smith Machinery Co.
N. Y., Albany (1-2) Milton-Hale Machinery Co.
Buffalo (2) Dow & Co., Inc.
New York (2) Air Compressor Rental & Sales
New York (1-2) Hodge & Hammond, Inc.
New York (1-2) Railroad Materials Corporation
Olean (2) Freeborn Equipment Co.
N. C., Raleigh (2) Carolina Tractor & Equipment Co.
Raleigh, (1) Smith Equip. Co.
N. D., Fargo (1-2) Smith Commercial Body Works, Inc.
O., Cincinnati (2) Finn Equipment Co.
Cleveland (2) S. M. Clancey
Cleveland (1) H. B. Fuller Equipment Co.
Cleveland (2) Gibson-Stewart Co.
Marietta (2) Northwest Supply & Equipment Co.
Toledo (2) M. W. Kilcorse & Co.
Okla., Oklahoma City (2) Townsco Equipment Co.
Oregon, Portland (2) Andrews Equipment Service
Pa., Allentown (2) H. N. Crowder, Jr., Inc.
Easton (2) Sears & Bowers
Oil City (2) Freeborn Equipment Co.
Philadelphia (1) Giles & Ransome
Philadelphia (2) Metalweld, Inc.
Pittsburgh (2) Atlas Equipment Corp.
Wilkes-Barre (2) Ensminger & Co.
Wilkinsburg (1) Arrow Supply Co.
S. C., Columbia (1-2) Smith Equipment Co.
Tenn., Knoxville (2) Wilson-Weesner-Wilkinson
Memphis (2) Tri-State Equipment Co.
Tex., Dallas (1) Service Equipment Co.
Dallas (2) Shaw Equipment Co.
El Paso (2) Equipment Supply Co.
El Paso (1) Mine and Smelter Supply Co.
Houston (2) Dye Welding Supply Co.
Houston (1) McCall Tractor & Equipment Co.
San Antonio (2) Patten Machinery Co.
San Antonio (1) San Antonio Machine & Supply Co.
Utah, Salt Lake City (1-2 Landes Engineering Co.
Vt., Barre (1-2) A. M. Flanders, Inc.
Va., Richmond (1-2) Highway Machinery & Supply Co.
Wash.,
Seattle (2) Star Machinery Co.
Spokane (2) Andrews Equipment Service
W. Va., Charleston (1) West Virginia Co.
Fairmont (2) Interstate Engineers & Constr., Inc.
Wisc., Milwaukee (1) Mekeel Engineering Co.
Wyoming, Cheyenne (2) Wilson Equipment & Supply Co.

Big Blue Brutes

Worthington Pump and Machinery Corp.

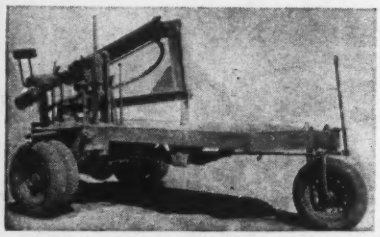
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

corrosion-resistant malleable iron castings and a quick-locking wedge key. Specially designed gaskets of synthetic rubber, neoprene or natural rubber provide a tight, permanent seal. Acting as sleeve, elbow and ball union, this coupling gives up to 40-degree flexibility at each joint.—*Drinkwater, Inc., 2323 South Michigan Ave., Chicago 16, Ill.*

• • •

Pavement Breaker

Adaptable to such work as breaking out floors, small highway patches, etc., a new three-wheel breaker requires little head room, as the boom lies back on its axis. When the boom is raised, a



rear brace holds it in place. The machine may be towed by any light car.

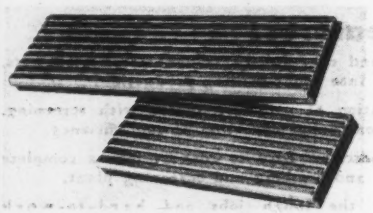
The breaker cuts a width ranging from 6 in. to 5 ft. Swing, blow and propulsion are pneumatically operated, with all controls within easy reach of the operator.—*Rapid Pavement Breaker Co., 1517 Santa Fe Ave., Los Angeles, Calif.*

• • •

Steel Stair Tread

Safety is an integral part of a new all-steel grooved tread and stair step for stairs of open or steel riser type. The tread is bolted or welded direct to the steel stringers.

The grooved tread surface has a non-slip abrasive grip filler. The safety



grooves are interlaced with slots for drainage, which also help to keep the stairs free from clogging materials.—*Wooster Products, Inc., Wooster, Ohio.*

• • •

Multi-Gang Box

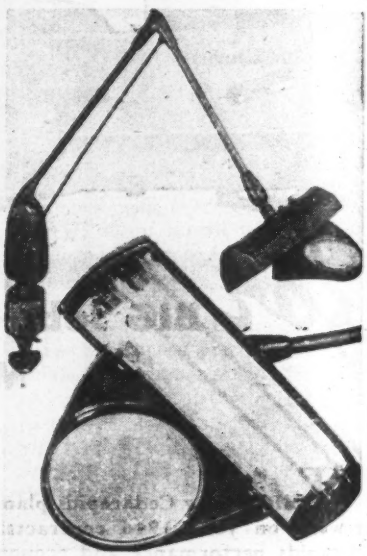
Designed especially for call and signal system work, a complete series of Multi-Gang receptacle and device boxes are available from single up to 12-gang, ranging in size from 4⅝x2⅞x2¼ in. to 4⅝x22¾x2¼ in.

The cover and base of 1- to 3-gang boxes inclusive are provided with groups of 3 twistouts for #500 and #700 Wiremold on each side and ends, and with conduit knockouts in base. The 4- to 12-gang boxes inclusive have 2 twistouts for #500 and #700 Wiremold and 1 twistout for #1000 Wiremold in cover and base, no conduit knockout in base. The 5- to 8-gang boxes inclusive have 1 group of twistouts on ends and 2 groups on side; the 9- to 12-gang have 1 group on ends and 3 groups on sides.—*Wiremold Co., Hartford 10, Conn.*

• • •

Fluorescent Magnifier

Magnification added to fluorescent lighting have been combined in a unit for use by engineers and draftsmen. The "Super Sight" magnifying lens and



light assembly, mounted on a well balanced bracket, can be quickly placed in any position over a work area.

This magnifying lens is available with three types of brackets and in two sizes.—*The Boyer-Campbell Co., Safety Division, 6540 St. Antoine St., Detroit 2, Mich.*

• • •

Rubber-Base Paint

No etching or preparation is necessary for any surface to be painted with the recently developed Rubbermastic paint. This product can be applied to walls, roofs or floors of concrete, brick, stucco, wood or metal, in wet, damp or dry condition. The welding qualities of the paint are said to effect a vulcanized water proofing job in colors.—*Guaranteed Products, 1117 Crenshaw Blvd., Los Angeles, Calif.*

NEW LORAIN "41" SERIES!

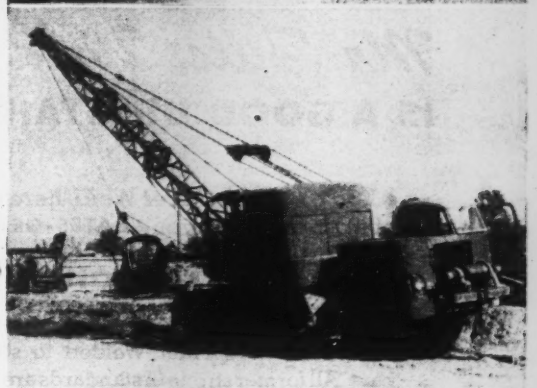
LORAIN 41, 2-SPEED, CHAIN DRIVE CRAWLER

Entire mounting is new, longer, wider, heavier.
30" swamp type treads standard.
Two travel speeds standard — ¾ and 1⅜ MPH — either direction.
Steers from cab in any swing position.
New, positive 4-way ratchet and pawl tread and travel lock.
Greater crane capacities.
Greater clamshell and dragline bucket capacities.
Convertible to shovel, crane, dragline, clamshell, backdigger.

The Three New Rubber-Tired Lorains

MOTO-CRANE 414 (4-WHEEL DRIVE)

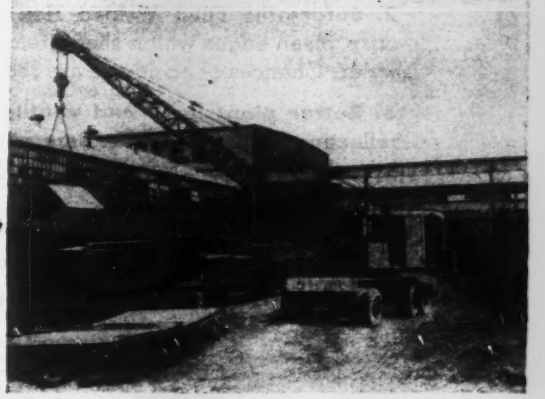
Greater crane capacity—now 20 tons.
Carrier specially designed for shovel and crane loads.
Ten forward speeds, 1 to 28 MPH. Two reverse speeds.
Six wheels. Four dual-tire rear wheels powered by two worm driven axles.
Air brakes on four rear wheels.
Convertible to shovel, crane, dragline, clamshell, backdigger.



MOTO-CRANE 416 (6-WHEEL DRIVE)

Here, for the first time commercially—the heavy-duty rubber-tired Moto-Crane that was developed for Military Service and came out with top honors for stamina and performance!

20-ton crane capacity.
Six-wheel drive. All axles double-reduction drive.
Eight speeds forward, 1 to 31 MPH. Two reverse speeds.
Power-assisted steering.
Air brakes on all six wheels.



SELF-PROPELLED CRANE 414

20-ton crane capacity.
Single engine, single operator.
Six wheels with power on four worm driven rear wheels.
Four travel speeds in both directions, 1 to 7 MPH.
Simultaneous hoist, swing, travel and boom derricking.
Air brakes on four rear wheels.
Air power, finger-tip steering.
Dual-tired front wheels, differential type to eliminate scuffing.

THE THEW SHOVEL COMPANY • Lorain, Ohio

Reg. Trade Mark

thew-Lorain

CRANES • SHOVELS • DRAGLINES • MOTO-CRANES

• Look, says *Mr. Fillet Weld,* here's the type of stair tread for you—**BATES•GRATES.**

for these reasons:

1. Stronger—**BATES** stair treads feature Hex Bars which are Fillet Welded to sturdy main bars. All former strength standards are exceeded.

2. Safer—the Fillet Welded Hex Bars have crisp, clean edges which shed grease, dirt and water. Chances of accidents are reduced.

3. Better plant light and ventilation—the reflecting bevels of the Hex Bars, with 90° corners, allow maximum transmission of light and air.

for stair treads, open steel flooring, floor armor and bridge decking . . .

. . . Get a Bid from BATES

Manufacturers' Activities

WILLIAM E. ZIPP has been appointed vice president in charge of sales for the manufacturing division of Ceco Steel Products Corp. He will have headquarters in the division's plant in Cicero, Ill.

Mr. Zipp was manager of sales for Ceco's manufacturing division from June, 1944, until his new appointment. He joined Ceco in 1933 to inaugurate the steel window division. Previously, he had wide experience in the architectural construction and window fields.

A. E. HUDSON Co. of Peoria, Ill., and the Indiana Equipment Co., of Indianapolis, Ind., have been appointed distributors for Bucyrus-Erie shovels, draglines and cranes.

HOWARD DE FRANCEAUX, who recently resigned as sales manager of the Rochester Can Co., Rochester, N. Y., has opened a Washington, D. C. office and service bureau for manufacturers to handle such problems as reconversion pricing, contract terminations and renegotiations, together with U. S. Government and foreign government procurement.

LLOYD SUMNER BURDICK, 37, for the last year district representative of Caterpillar Tractor Co. in North Dakota, Montana, Alberta and Saskatchewan, was killed recently when two sections of a Great Northern Transcontinental train collided at Michigan, N. D. Mr. Burdick was graduated from the University of Illinois in 1931. From 1942 to 1944 he served with the U. S. Army Engineers during the construction of the Alaskan Highway.

E. H. WATKINS has been promoted from assistant branch manager, International Harvester Co., New York City, to manager of a new motor truck

branch in Syracuse. Mr. Watkins started at the Cleveland motor truck branch in 1935 as a salesman and in 1937 became retail sales manager. In 1939 he was transferred to New York where he was in charge of sales promotion. In 1943 he became assistant manager at New York.

Paul McLaughlin has just been promoted from the position of national account supervisor of New York to assistant manager, where he will specialize on fleet sales. Mr. McLaughlin started with International Harvester at the Philadelphia motor truck branch in 1919.

S. Blackwell Taylor, formerly manufacturing vice president of the Reliance Electric & Engineering Co., Cleveland, Ohio, has been elected president and a director of the Parker Appliance Co., of that city, succeeding H. I. Markham, now chairman of the board.

Wm. Schannep has been appointed the new district representative in the Pacific northwest for Pioneer Engineering Works of Minneapolis, Minn., at Seattle, Wash. His territory includes Washington, Oregon, Idaho, Western Montana, Alberta and British Columbia.

For the last ten years Mr. Schannep has been employed by the Feenaughty Machinery Co., Portland, Ore. With his previous experience with the Oregon State Highway Department and his ten years selling construction equipment, Mr. Schannep is well fitted to assist owners and operators of crushing, screening and conveying equipment.

The Board of directors of the American Hoist & Derrick Co., St. Paul, Minn., has elected the following officers: Frederic Crosby, chairman of the board; Harold O. Washburn, president; Rolf E. Ljungkull, vice-president of engineering, Donal B. Botkin, vice-president of manufacturing; Stanley M. Hunter, vice-president of sales; James F. Bishop, secretary and assistant treasurer; and Robert J. Henry, assistant secretary.

The Concrete Construction and Supply Co., 2001 Taylor Street, Columbia, S. C., has changed its name to the Smith Equipment Co., and has employed Fred G. Mylius as a representative. Mr. Mylius was associated with the Lehigh Portland Cement Co., prior

● The seal that keeps the water in and the air out consists of two wearing surface seal rings made of Tungsten Carbide and a grease container. One seal ring rotates on the shaft and is held in contact with the stationary ring by a stainless steel spring. This method of sealing is specially suited for high pressure work and when handling dirty water—the higher the pressure the tighter the seal. Dirty water cannot get into the grease and damage the shaft and bearings. Air is kept out of the pump so there's no loss of vacuum and high priming efficiency is maintained.

For details, see your local Carver distributor or write direct.

THE CARVER PUMP CO., Muscatine, Iowa

to his entrance into the United States Army in 1942. O. Stanley Smith is president of the company and G. W. Maxwell Jr., is vice-president.

WILLIAM C. ROBINSON, who has been assistant to the director of personnel relations for Lukens Steel Co. and its divisions, By-Products Steel Corp. and Lukenweld, Inc., at Coatesville, Pa., since 1944, has been appointed assistant director.

Mr. Robinson was born in Philadelphia, Pa., and attended Columbia University. He has been engaged for a number of years in labor relations work and went to Lukens from The Mead Corp., Chillicothe, Ohio, where he was assistant director of personnel relations.

EDWIN S. PHILLIPS, 81, retired engineer, who died in Washington, D. C., recently, had been vice-president of the American Road Machine Co., now the Good Roads Machinery Corp., and helped rebuild U. S. Route 1 between New York and Baltimore. Before his retirement 10 years ago he was manager of the Philbrian Corp., Kennett Square, Pa., ignition system manufacturers.

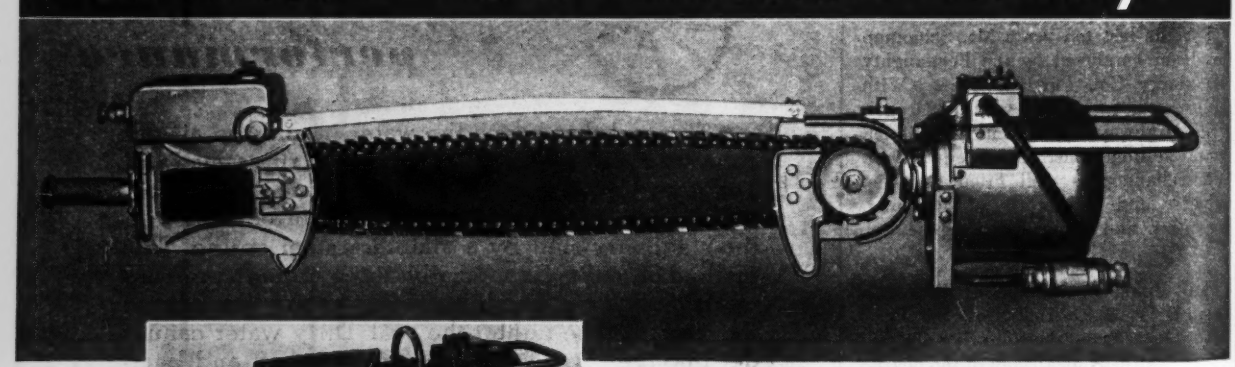
CITATION of The Rust Engineering Co., Pittsburgh, Pa., for a safety record surpassing any previously set under the U. S. Engineer Department in the hazardous job of reactivating TNT plants, has been issued by the St. Louis, Mo., District Engineer Office. A record of 910,292 man hours worked by Rust without a lost time accident on the Weldon Springs, Mo., Ordnance Project, drew the commendation from Col. L. B. Feagin, District Engineer.

LEWIS A. HARLOW, who recently took over the post of manager of the advertising division of Fairbanks, Morse & Co., was graduated from Harvard University with honors in 1922. Shortly after his graduation he organized his own business—a publishing house for instruction manuals and textbooks for public schools. Some time later, he also became interested in radio as an entertainment and commercial medium. He spent a number of years producing and managing programs, in addition to managing his publishing interests. In 1943 he joined Fairbanks-Morse as assistant advertising manager; and, until his recent advancement to manager, helped supervise the many and varied advertising activities of the company.

DANIEL J. BRADLEY has been appointed manager of the International Harvester Co.'s Philadelphia motor truck branch. He succeeds C. D. Roice who has joined Harvester's foreign operations division. The company's motor truck operations at Allentown, Reading, and West Philadelphia, Pa., and Camden, and Trenton, N. J., as well as the many dealerships in the Philadelphia territory will come under Mr. Bradley's immediate jurisdiction.

Bradley joined the Harvester motor truck organization as a retail salesman at Philadelphia in July, 1934. He served successively as national account salesman and wholesale man. He later became retail manager at Mt. Vernon, N. Y., and still later was transferred to Pittsburgh in a similar capacity. Since

AVAILABLE NOW Immediate Delivery!



Portable two-man electric motor drive

TIMBERHOG SAW

suited for general timber cutting in construction, railroad, mine, shipyard or plant maintenance — 1½ HP Universal electric motor, 115 v. DC or 110 v. AC, 24" capacity, weight 65 lbs. Easily transported—a useful tool for construction operations. Priority required.

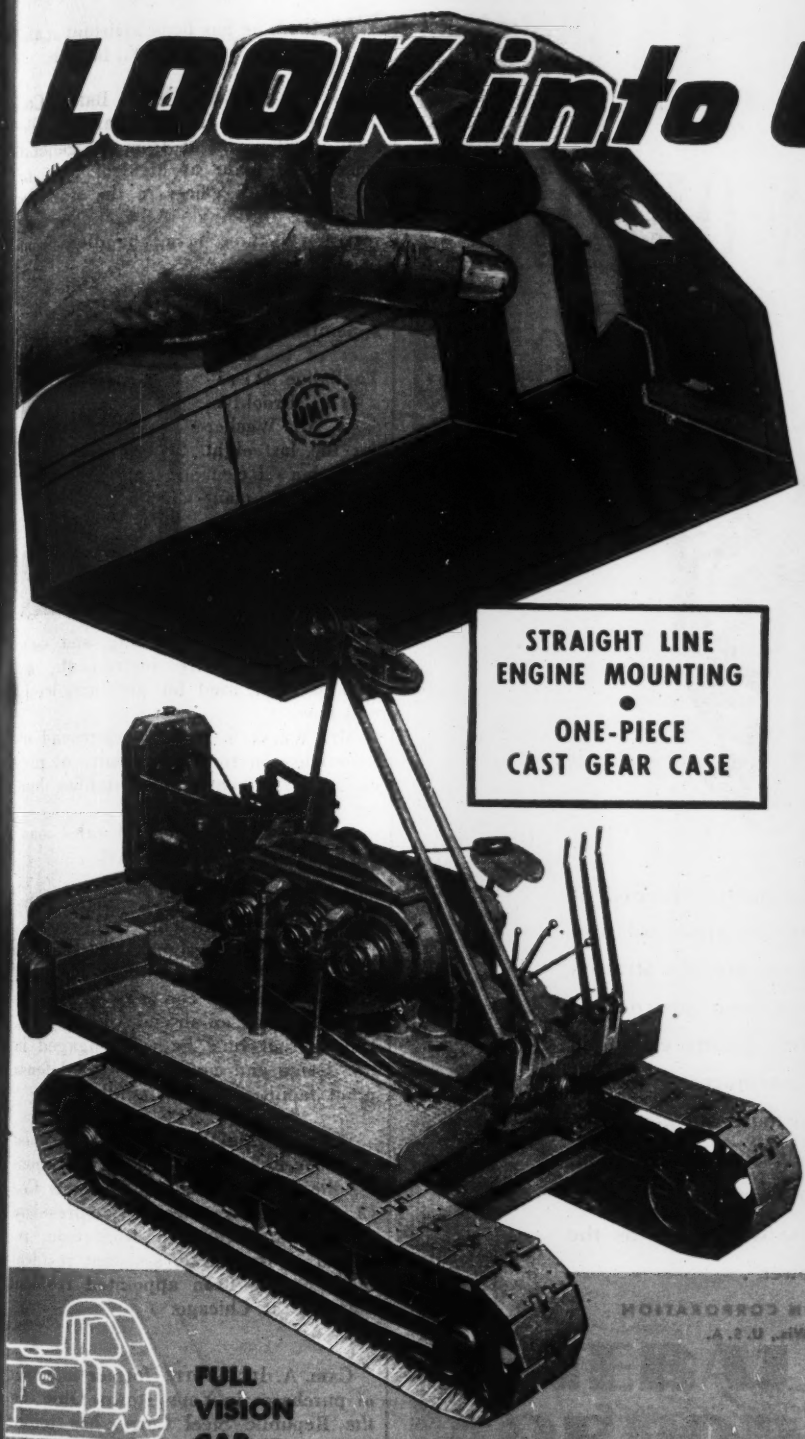
One man Portable TIMBERHOG SAW — same sturdy construction — 1½ HP Universal electric motor, 110 AC or DC, 20" capacity — weight 54 lbs. Priority required.

TIMBERHOG REED-PRENTICE CORP. WORCESTER MASS. U.S.A. SAWS

"ORIGINAL and LARGEST manufacturers of portable timber saws—since 1927."

WORCESTER MASSACHUSETTS

LOOK into UNIT!



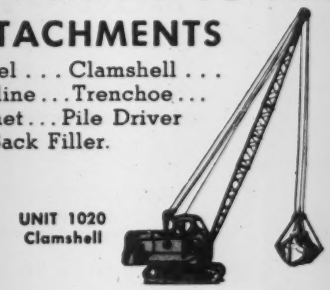
Lift the cab from any UNIT crane or shovel. You'll find the following exclusive features not found in any other comparable machine:

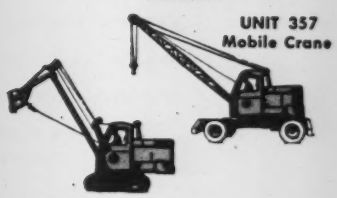
- **Compact, modern design . . . all parts readily accessible.**
- **Gasoline engine mounted in straight line with main machinery.**
- **Drop-forged alloy steel gears and splined shafts, heat-treated.**
- **Automatic traction brakes . . . no manual control required.**
- **Disc type clutches, interchangeable with easy and foolproof adjustment.**
- **One-piece cast gear case...simple in design and built as carefully as the finest automotive transmission . . . dust-proof and oil tight.**

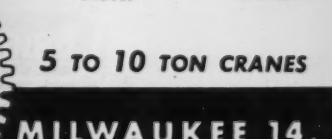
And that isn't all! A UNIT costs less . . . is more economical to operate . . . is built to endure. Investigate today.

Convertible TO ALL ATTACHMENTS

Shovel . . . Clamshell . . .
Dragline . . . Trenchoe . . .
Magnet . . . Pile Driver
. . . Back Filler.







FULL VISION CAB

Operator can see in ALL directions. No "blind spots". Promotes safety. Increases job efficiency.

½ AND ¾ YD. EXCAVATORS

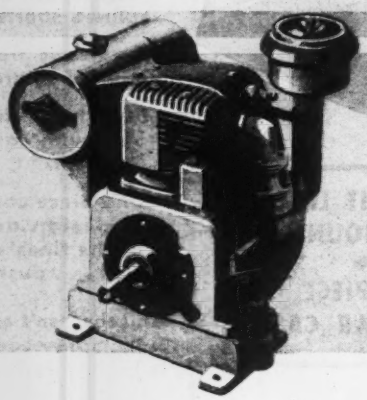
5 TO 10 TON CRANES

UNIT CRANE & SHOVEL CORP.

MILWAUKEE 14, WISCONSIN, U.S.A.

A4868-IP-C

BRIGGS & STRATTON ENGINES NOW ON THEIR WAY BACK TO YOU!



BACKED by an outstanding record of valiant service in scores of standard and special wartime applications, Briggs & Stratton 4-cycle gasoline engines have returned to peacetime activities. With greatly expanded facilities for precision manufacture, we are now producing more and more quick-starting, dependable, trouble-free, Briggs & Stratton gasoline engines in a full range of sizes and models — recognized the world over as the preferred "air-cooled power".

BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wis., U. S. A.

Air-Cooled Power

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES

April, 1944, he has been assistant manager of the Syracuse, N. Y., branch.

THE A. P. GREEN FIRE BRICK CO. has moved its advertising and public relations department from its general offices and plant at Mexico, Mo., to St. Louis, with offices in the Railway Exchange Building. All company advertising is now being handled from that office.

THE PORTABLE PRODUCTS CORP., has appointed E. D. Wacker general manager of its C. J. Tagliabue Division, Brooklyn, N. Y. Mr. Wacker for the last eight years has been general sales manager, and has been associated with C. J. Tagliabue for 22 years. Tagliabue makes precision indicating, recording and controlling temperature instruments, as well as those used for pressure, level, and flow.

Mr. Wacker's broad background of experience in the manufacture of precision instruments well qualifies him for his new position.

His successor as general sales manager has not yet been named.

A. A. NELSON, who for many years was associated with The Nicholson Co., Inc., New York, designers and builders of concrete storage handling facilities, has rejoined the company as a vice-president after an absence of two years. During that time he was engaged in the design and construction of defense plant facilities in the middle west.

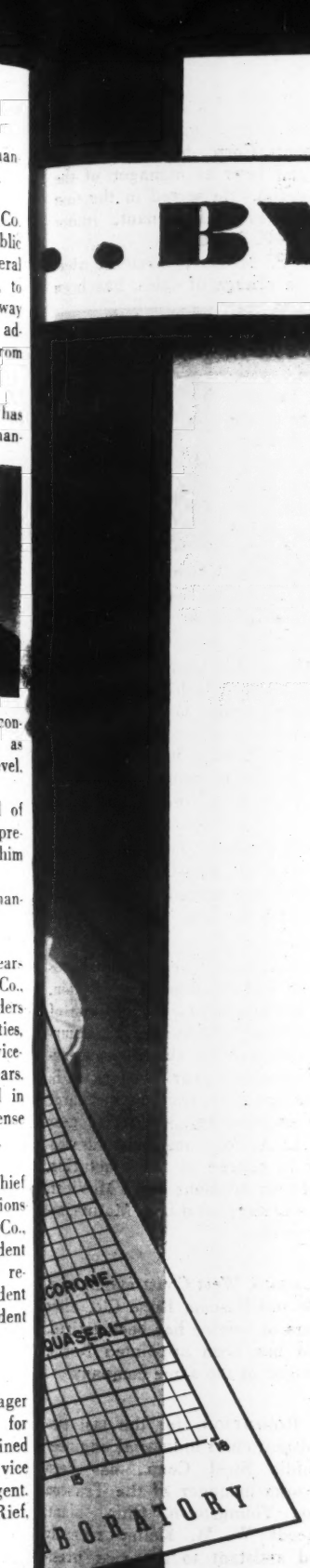
W. LYLE MCDANIEL, formerly chief engineer in charge of plant operations for the Massey Concrete Products Co., Chicago, has been elected vice-president succeeding Walter H. Robertson, resigned. Ross Clarke, assistant resident manager has been appointed resident manager at Chicago.

CARL A. ILGENFRITZ, former manager of purchases in Youngstown, Ohio, for the Republic Steel Corp., has joined Carnegie-Illinois Steel Corp., as vice president and general purchasing agent. He takes the place of Frank J. Rief, retired.

THE INDUSTRIAL HYDRAULICS CORP. has recently established offices in the Cleveland Trust Bank Bldg., Painesville, Ohio. The principals are W. T. Stephens, president and chief engineer and W. B. McClelland, vice president and sales manager.

. . BY DECADES

Preparedness for Post-War Industry Developments based on cumulative data long in preparation

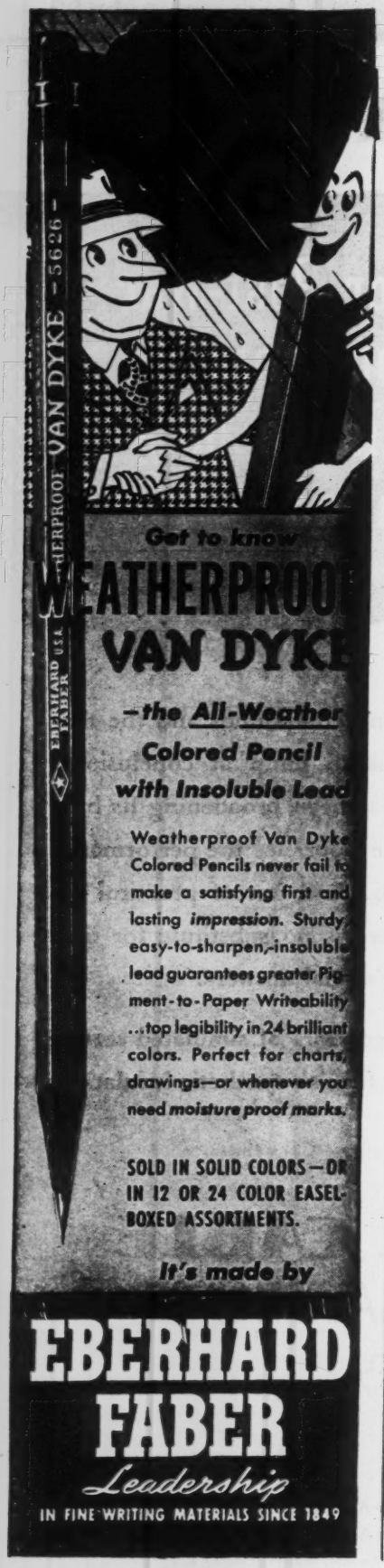


In the comparison of rubber insulating compounds and the new synthetics, it is easy and hazardous to jump at conclusions. Through the years, General Cable has been broadening its base of data by which to predict with some assurance the performance to be expected of the new materials. And out of practical experience, it recognizes, too, that there is no substitute for time in the determination of the industry's final answers.

These and other tests, extending over years of simulated service conditions, prepare General Cable to furnish synthetic insulations for all operating conditions.

GENERAL CABLE CORPORATION

General Cable Corporation Sales Offices are located at Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D. C.)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with Insoluble Lead
Weatherproof Van Dyke Colored Pencils never fail to make a satisfying first and lasting impression. Sturdy, easy-to-sharpen, insoluble lead guarantees greater Pigment-to-Paper Writeability ...top legibility in 24 brilliant colors. Perfect for charts, drawings—or whenever you need moisture proof marks.
SOLD IN SOLID COLORS—OR IN 12 OR 24 COLOR EASEL-BOXED ASSORTMENTS.
It's made by
EBERHARD FABER
Leadership
IN FINE WRITING MATERIALS SINCE 1849

APPOINTMENT of L. I. Barker, Massillon, Ohio, as assistant district manager for the Republic Steel Corp.'s, Cleveland sales office has been announced by J. M. Schlendorf, vice president in charge of sales. Mr. Barker was associated with the Carnegie-Illinois Steel Corp. in Cleveland before joining the sales office of the Union Drawn Steel Co. there in 1924. In 1931 he was named manager of the office after the company merged with Republic Steel Corp., and since 1938 he has been assistant manager of sales of Republic's Union Drawn Steel division at Massillon.

EMIL C. OSTLUND has been appointed chief industrial engineer of American Steel & Wire Co., subsidiary of United States Steel Corp. He succeeds Cecil W. Guyatt, recently named assistant to the chairman of operating committees, United States Steel Corp. of Delaware.

LOUIS HERSCOVITZ, formerly sales manager of the Western division of The Ruberoid Co. at Chicago, has been elected vice-president and general sales manager with headquarters at the main offices in New York. Mr. Herscovitz has been associated with Ruberoid for the past seventeen years and in 1941 was elected to the board of directors. Except for two years of service with the U. S. Marines in the first World War, he has been connected with the building materials industry all of his working life, having been first employed by The Barrett Co. and later as a sales executive of H. F. Watson Co., asphalt roofing manufacturers, acquired by Ruberoid in 1928.

Louis Herscovitz

A thorough believer in the value of personal contact with the trade, he has spent much time in the field and has a wide acquaintance among dealers, contractors and architects.

Walter G. Cowan

A further announcement by the Ruberoid directors was the election of Walter G. Cowan, formerly manager of the company's eastern division, as vice-president and general manager of manufacturing. Mr. Cowan has been with Ruberoid since 1938 and in 1941 was elected to the board of directors. He had been connected for twenty years with Certain-teed Products Corp., first as Chicago manager and later as manager of the roofing division. He served in the first World War as a lieutenant, junior grade, in the U. S. Navy.

SAMUEL P. MOFFIT, formerly vice-president in charge of sales, has been promoted to executive vice-president. Stanley Woodward, vice-president in general charge of the southern division, Baltimore, and E. M. Railton, vice-president in general charge of the western division with headquarters in Chicago, have been made members of the executive committee.

Samuel P. Moffit

O. G. MANDT has been elected president of the Jaeger Machine Co., Columbus, Ohio, replacing Gehhard Jaeger, now chairman of the board. Mr. Mandt joined Jaeger in 1927, having formerly operated a cement machinery manufacturing business in Iowa.

PHILIP E. FURLONG, head of the Texrope division at Allis-Chalmers, Milwaukee, Wis., has retired after 50 years of service with the firm.

WILLIAM A. BARR, president of Foote Bros, Gear and Machine Corporation, Chicago, Ill. announces the election of these additional officers: L. F. Campbell, vice-president in charge of manufacturing, precision gear division; R. B. Moir, assistant vice-president in charge of sales engineering, industrial gear division; E. A. Johnson, assistant vice-president in charge of manufacturing, industrial gear division; L. C. McVicar, assistant secretary; and L. J. Malina, assistant treasurer.

E. B. DRISKO, West Coast manager of Broderick and Bascom Rope Co., after many years of service has been retired. T. Verhof has been appointed Northwest manager of the same company.

PETER ROBERTSON, for the last two years assistant chief industrial engineer of Republic Steel Corp., has been named works manager of the Truscon Steel Co., Youngstown, Ohio, plant. He succeeds W. M. Kelley recently appointed assistant to the vice president in charge of operations for Republic Steel.

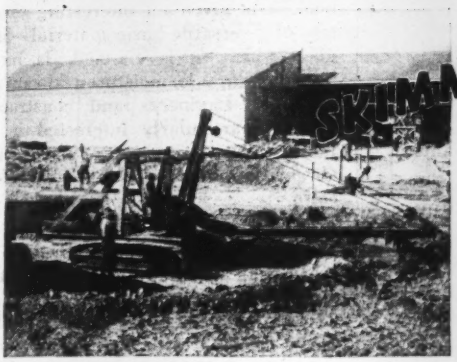
Robertson joined Republic in 1934. He assisted in installing modern production methods for the Berger Manufacturing division and spent two years in similar work at Truscon.

SHOVEL

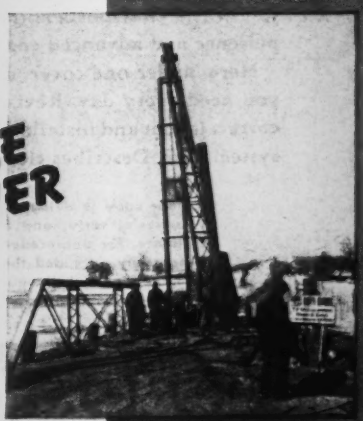
CONVERTIBLE TO..

ILLINOIS—
"Hewing to the line" and leaving a firm, clean, vertical bank.

INDIANA—
Erecting tanks for oil-refining use. Steel sheets weigh about 3 tons.



SO. AFRICA—
Levelling ground for workshop and garage extensions.



IOWA—
Driving 34-foot piling for a new and larger bridge with an 1800-lb. hammer.

WYOMING—
Digging pits and placing dirt around concrete forms for a new overpass at the rate of 300 yds., in 9 hours time.

MONTANA—
Cleaning, deepening and widening a creek that serves as a run-off for several mine smelters.

BUILDERS OF ROAD MACHINERY

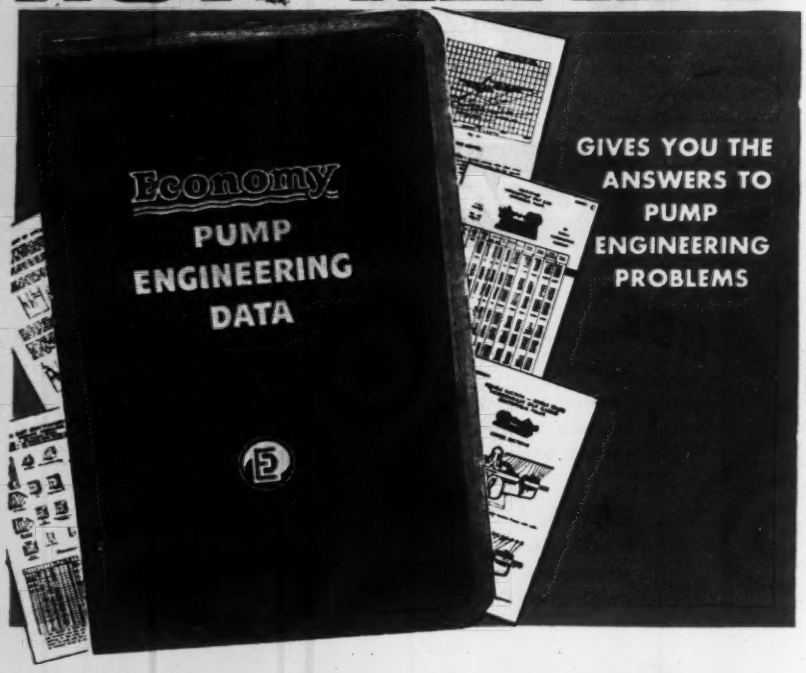
ARMY E NAVY

Austin-Western

SINCE 1859

BUY MORE WAR BONDS

NOW READY



A timely contribution to the pump industry—416 pages of factual data just when vital postwar problems require authentic facts, sound experience and advanced engineering practice.

Here, under one cover, are hundreds of handy tables and diagrams you need every day. Revised, improved and new data governing the correct layout and installation of sewage, drainage, processing, heating systems, etc. Describes clearly and exactly the way to do the job right.

Indispensable to Executives, Engineers, Plant Managers, Maintenance Men, etc. Sent free in response to requests on business letterheads.

If your copy is delayed in reaching you, we're sorry, and ask your indulgence. The unprecedented demand temporarily exceeded the manpower for handling—but all requests received to date are being filled in rotation.

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FOR OVER THIRTY YEARS MAKING BETTER PUMPS DO MORE

BOILERS
"SNAP OUT OF IT!"
MARION SOOT BLOWERS

modernize boilers right now! They do this work:

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MARION SOOT BLOWERS eliminate stubborn soot with minimum waste of steam. Type "F" for water tube boilers blows in any length of arc from 15 to 345 degrees. "Keeps on Rollin' " to right or left as desired. Favorites with skilled engineers and power plant owners, MARION SOOT BLOWERS are made for all sizes and types of boilers. Parts are interchangeable. Continuous service with low replacement and repair costs.

Type "F" Automatic Valve, Balanced Head

Write for Specifications and Prices
Save Coal, Time, and Worry

THE MARION WAY

MARION MACHINE, FOUNDRY AND SUPPLY CO. • MARION, INDIANA, U. S. A.

Manufacturers' Publications

Under Water Concrete—This folder discusses a line of engineering work that always presents intricate problems of correct subaqueous concrete applications. It features a special kind of pile encasing to protect wood piling, for reconditioning of defective piling and to protect steel piling from rust.—*The Presscrete Co., Inc., 243 Graybar Building, New York 17, N. Y.*

Opposed Piston Diesels—A profusely illustrated booklet of 28 pages has been issued to describe diesel engines "refined in the crucible of war." They are now also available for commercial service.—*Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.*

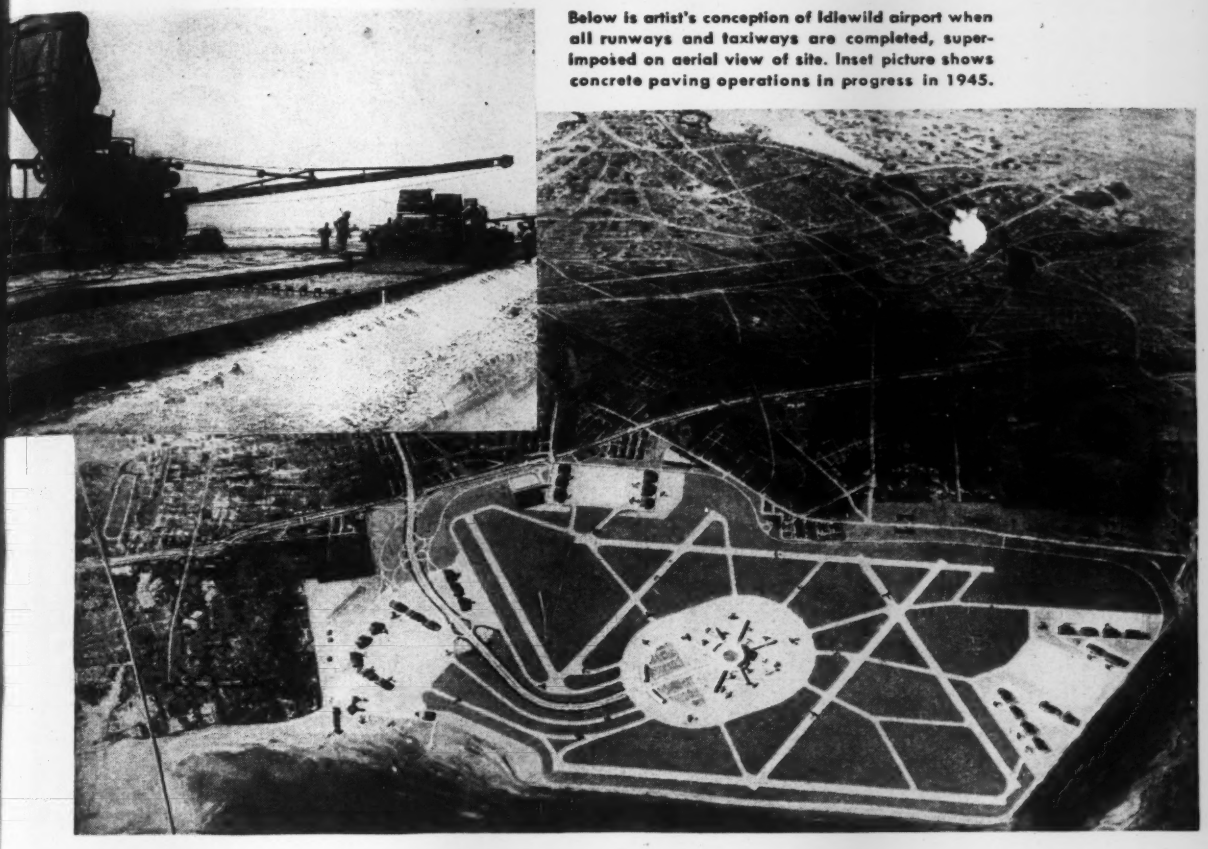
Fiber Glass—In an 8-page illustrated booklet is given an interesting exposition of a versatile basic material—fiberglas—which, it is claimed, is incombustible, durable, moisture-resistant and sanitary. Engineers and constructors will be particularly interested in the facts about its use for insulation.—*Owens-Corning Fiberglas Corp., Toledo, Ohio.*

High Strength Steels—Design and fabricating advantages of low-alloy high-strength steels are presented in a new 24-page booklet. It describes two low-alloy steels with minimum yield strengths of 50,000 and 55,000 psi.

The booklet tells how high-strength steels enable a lighter sheet steel "shell" to carry more of the load in transportation equipment. This lighter weight—without sacrifice of strength—tends to give safe high speeds and bigger pay loads, at less cost.—*The American Rolling Mill Co., Middletown, Ohio.*

Brick Masonry Design—This real textbook of design formulas and procedures in 80 pages covers the construction of reinforced grouted walls and other masonry members. It deals with loads and stresses; bearing, filler and parapet walls; joist supports; material and workmanship, etc. A supplement gives important engineering data and construction details as required by building codes.—*Davidson Brick Co., 4701 Floral Drive, Los Angeles 22, Calif.*

Engineering Instruments—This 100-year-old company has produced a new



Below is artist's conception of Idlewild airport when all runways and taxiways are completed, superimposed on aerial view of site. Inset picture shows concrete paving operations in progress in 1945.

New York's Idlewild is being **paved with Concrete**

Runways and taxiways for New York's famous Idlewild Airport are designed to carry planes weighing up to 300,000 pounds. The concrete runway slabs are 12-in. thick and 200 ft. wide—taxiways are 14-in. thick and 100 ft. wide.

Idlewild is a preview of the type of construction required in major airports to safely handle giant planes of the future.

Portland cement concrete is the ideal material for major airport construction because concrete pavements can be designed as engineering structures with the strength needed to carry the wheel loads of modern planes. Such concrete pavements usually cost less to build than any other pavement of equal load-carrying capacity.

The low first cost of concrete, its low maintenance expense and long service life —*give low annual cost*—the true measure of pavement economy.

Our technical staff will gladly assist engineers in determining an economical concrete pavement design for any condition of load or service.

PORTLAND CEMENT ASSOCIATION

Dept. A10a-17, 33 West Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

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Snow Plow and Ice Removal
BLADES
A proved record of superior performance--the result of long experience and research devoted to developing a special steel capable of withstanding the severe conditions present in snow removal service.
MADE FOR ANY TYPE SNOW PLOW
Various widths, lengths, thicknesses--flat or curved--standard or special--punched ready to fit your machine
SHUNK SAW-TOOTH ICE BLADE
Amazingly effective. Thoroughly breaks up and removes thick, slippery, or rutted ice and snow formations. Replaces all types and models of snow plow blades or maintenance units. No extra attachments.
Now is the time to order SHUNK Snow Plow and Ice Removal Blades--write for Bulletin and name of nearest distributor.
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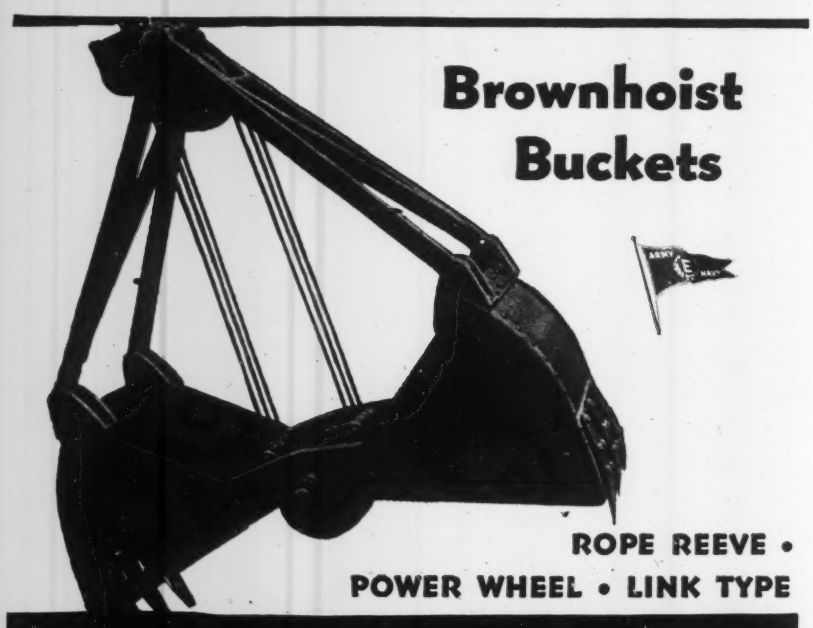


Handling ore, gravel, coal or dirt Brownhoist Buckets do a better job because: 1) Larger sheaves reduce rope wear, 2) Heavy carbon-steel digging lips take deep clean bites, 3) Extra-sturdy construction insures long-life. Write to Industrial Brownhoist Corporation, Bay City, Michigan. Offices in New York, Philadelphia, Pittsburgh, Cleveland and Chicago.

bulletin describing engineering instruments now available for prompt shipment. Among those listed are: Transit, telescope levels, plane table outfits, alidades, drawing boards, current meters, water level recorders, wind instruments, topographic equipment, etc.—*W. & L. E. Gurley, Troy, N. Y.*

Elections and Activities

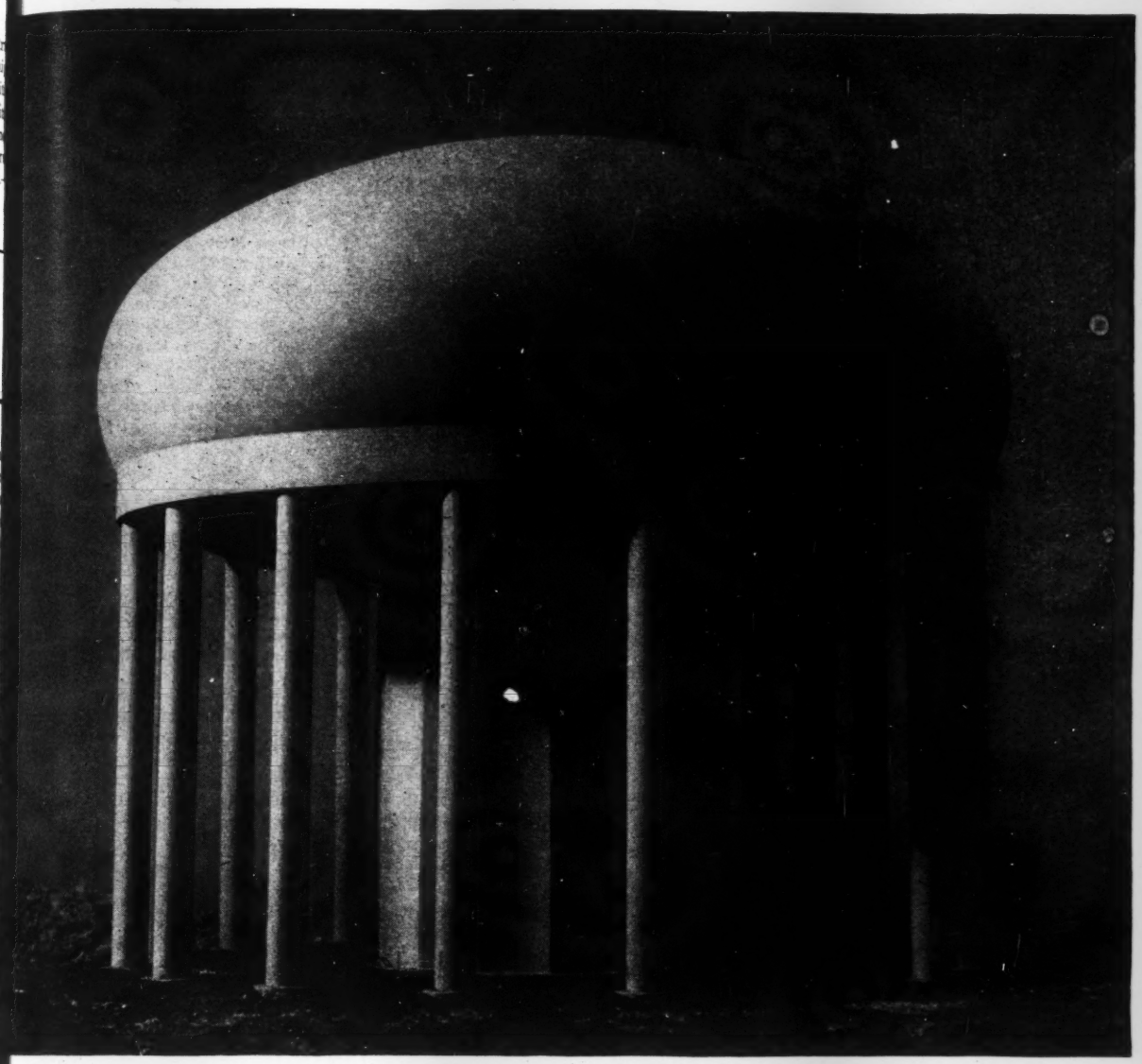
Arthur P. Kuranz, Manager of the Waukesha, Wis. water utility, has been appointed to a National Committee of the American Water Works Association to study the possibilities of a public relations program for the group.

Albert Hamrock has been installed as president of Canton, Ohio, chapter of the National Association of Power Engineers, succeeding Walter Dieffenbacher. Others installed by Fred Basler, former president, were Henry C. Fashbaugh, vice president; Herbert Zeller, corresponding secretary; Albert Richardson, financial secretary; George Smith, treasurer; Clarence Huffman, conductor and Albert Tackes, doorkeeper.

Governor Gregg Cherry of North Carolina has appointed these five members of the State Building Code Council to serve for a 4-year term: Walter W. Hook, Charlottee, N. C., to represent state architects; Robert H. Pinnix, Gastonia, N. C., to represent general contractors; Ross Shumaker, Raleigh, N. C., to represent structural engineers; J. W. Warr, Hamlet, N. C., to represent plumbing and heating contractors; and Hill L. Kiser, Charlotte, N. C., to represent organized labor.

The Bremerton Construction Council of Bremerton, Wash., has opened offices in that city, with Herbert L. Coon as president, Sam Linden, vice-president and Louis C. Mignon, secretary-treasurer.

Eugene Zeiss, San Diego, South California executive, has been appointed registrar and executive secretary of the Contractor's State License Board, with headquarters in Sacramento. The board also elected Jess Worthington, painting contractor of San Diego, as chairman and J. Philip Murphy, engineering contractor of San Francisco, as vice-chairman. The board licenses approximately 38,000 contractors in the state and maintains offices in San Francisco, Los Angeles, and San Diego.



New DESIGN FOR SUPPORTING LARGE ELEVATED WATER TANKS

The 2,000,000-gal. elevated water tank illustrated by the above drawing is being erected at the present time in the Washington, D. C., waterworks system. It is a spheroidal tank supported on an outer ring of cylindrical columns and a central fluted column of new design. The outer columns are 4 ft. in diam. and the central unit is 40 ft. diam. The tank is 49 ft. to the bottom and has a range in head of 34 ft. 6 in.

The use of a central fluted column is a typical example of the many new features of design we have used in the construction of large elevated water tanks during the last two decades. Whenever you are making plans for improvements in large waterworks systems, let us give you our ideas on the most practical designs to meet your requirements. Write our nearest office. There is no obligation.

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Engineers
Architects
Contractors

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You'll search a long time to find an instrument comparable to this Leupold product. Men who use it confirm our belief that all requirements are conveniently incorporated in this one accurate, moderately priced level.

Telescope is external focusing, 13 inches long, with 1¼ inch objective; achromatic lens with a flat field and magnification of 18 diameters . . . Horizontal circle for turning angles and two auxiliary standards to which the telescope may be shifted for plumbing vertical lines . . . Instrument weight—8 lbs. Tripod weight—7 lbs . . . Hardwood carrying case.

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Reports and Pamphlets

(*Continued from page* 128)

ARMY-NAVY CONTRACTORS GUIDE FOR PRIME AND SUBCONTRACTORS—Issued jointly by the War and Navy departments. Readjustment Distribution Center, 90 Church St., New York 7.

BIBLIOGRAPHY ON SOIL MECHANICS, 1940-1944—By R. Ruedy. National Research Council, Ottawa, Ont., Canada. 25c.

ASTM STANDARDS ON CEMENT (with related information)—169 pp. American Society for Testing Materials, Philadelphia 2, Pa. $1.50.

ETUDE DE LA REPARTITION DES TENSIONS DANS UNE PIECE ENCASTREE EN FONCTION DE L'ANGLE D'INCIDENCE—By Henry Favre and Rudolf Bereuter. Ag. Gebr. Leemann & Co., Stockerstrasse 64, Zurich 2, Switzerland. Fr. 4.

SETZUNGEN INFOLGE SENKUNG, SCHWANKUNG UND STRONUMG DES GRUNDWASSERS—By Rob. Haefeli and W. Schaad. Ag. Gebr. Leemann & Co., Stockerstrasse 64, Zurich 2. Fr. 3.60.

PUBLICATIONS, 7th volume—International Association for Bridge and Structural Engineering. Ag. Gebr. Leemann & Co., Stockerstrasse 4, Zurich 2 Switzerland. Fr. 30.

LITTLE ROCK MUNICIPAL WATER WORKS, Ninth Annual Report—Year ending Dec. 31, 1944. Little Rock, Ark.

FEDERAL HOUSING ADMINISTRATION, Eleventh Annual Report—For the year ending Dec. 31, 1944. National Housing Agency, Federal Housing Administration, Washington 25, D. C.

CINCINNATI WATER WORKS REPORT FOR 1944—Department of Water Works, Cincinnati, Ohio.

NEWTON, MASS.,—ANNUAL REPORT OF THE CITY ENGINEER AND PLANNING BOARD for the year ending Dec. 31, 1944.

GARY, IND. FOURTH ANNUAL REPORT, SEWAGE TREATMENT WORKS, FOR 1944—Gary Sanitary District, Gary, Ind.

GROUND WATER SUPPLIES FOR RICE IRRIGATION IN THE GRAND PRAIRIE REGION—Arkansas Agricultural Experiment Station Bulletin No. 457. University of Arkansas, Fayetteville, Ark.

MINIMUM SANITARY REQUIREMENTS FOR SWIMMING POOLS AND BATHING PLACES—Revised May 1, 1945. Division of Sanitary Engineering. Department of Public Health, State of Illinois, Springfield, Ill.

LUBRICATION AND MAINTENANCE GUIDE FOR CONTRACTORS' EQUIPMENT, 2nd Edition—Gulf Oil Corp., Gulf Refining Co., Gulf Bldg., Pittsburgh, Pa.

GROUND-WATER RESOURCES OF THE EL PASO AREA, TEXAS—Superintendent of Documents, Washington, D. C.

SURFACE WATER SUPPLY OF HAWAII—July 1, 1941 to June 30, 1942. Superintendent of Documents, Washington 25, D. C. 25c.

A STUDY OF RADIANT BASEBO[ARD] HE[ATING] IN THE I-B-R RESEARCH H[OME]—[Engi]neering Experiment Station [Bulleti]ries No. 358. University [of Illi]Urbana, Ill. 35c.

DEBTOR AND CREDITOR COUN[TIES]: 1944—The Brookings Institu[tion] Wash]ton 6, D. C. 75c.

BUILDING CONSTRUCTION COST DATA—By R. S. Means, Box 6[, Dux]Mass. $1.60.

LEGAL ASPECTS OF CONTROLLI[NG HIGH]ACCESS—Public Roads Ad[ministra]By David R. Levin, Super[intenden]Documents, Washington 25, D. C.

FLOW OF LIQUIDS THROUGH V[ERTICAL] CULAR ORIFICES AND TRIANG[ULAR W]—By F. W. Greve. Engineering Ex[periment] ment Station Research Series No. Purdue University, Lafayette, Ind.

GEORGIA GOES FORWARD—The Record One Year's Accomplishment. The [Agri]cultural & Industrial Development B[oard] of Georgia, Athens, Georgia.

NATIONAL RESEARCH COUNCIL—Amer[ican] Geophysical Union Transactions of [the] Section on Hydrology National Acad[emy] of Sciences, Washington, D. C.

THE MASON SHORTAGE—Structural [Clay] Products Institute, Washington D. C.

MILWAUKEE IS READY—ANNUAL CONSOLIDATED REPORT OF THE COMMON COU[NCIL] 1944-45, Milwaukee, Wis.

A REPORT ON THE CONDITIONS EXIS[TING] IN THE POTOMAC RIVER BASIN. [Interstate] state Commission on the Potomac R[iver] Basin, Washington, D. C.

DESIGN AND CAPACITY OF GUTTER INLE[TS]—Engineering Experiment Station B[ulle]tin No. 30. North Carolina State [Col]lege, Raleigh, N. C. 25c.

STRESSES IN SOILS UNDER A FOUNDATI[ON]—By Walter H. Weiskopf. Reprinted [from] the Journal of the Franklin Insti[tute] Vol. 239, June 1945. Available from author, 45 W. 45th St., New York.

THE LOCAL HOUSING AUTHORITY AND ARCHITECT. By Oliver C. Winston. [Publ]lic Administration Service, Chicago Illinois. 60c.

CERTAIN REQUIREMENTS FOR FLEX[IBLE] PAVEMENT DESIGN FOR B-29 PLAN[ES]—U. S. WATERWAYS EXPERIMENT STA[TION] VICKSBURG, MISS. $3.

PROGRESS REPORT ON THE GROUND-W[ATER] RESOURCES OF THE LAS VEGAS ARTE[SIAN] BASIN, NEVADA—By George B. May[nard], C. H. Jameson. Prepared by the [Geo]logical Survey, U. S. Dept. of the [In]terior, in cooperation with the Ne[vada] State Engineer's Office, Carson [City], Nev.

A RECORD OF ACHIEVEMENT IN PEACE [AND] WAR—American Institute of Steel [Con]struction, 101 Park Ave., New Y[ork] N. Y.

SIX YEAR CAPITAL IMPROVEMENT PRO[GRAM] FOR MARYLAND Revised-1945—Mary[land] State Planning Commission, Balti[more] 18, Md. 25c.

POST-WAR PUBLIC WORKS HANDBOOK—[For] LOCAL GOVERNMENTAL AGENCIES—[Illi]nois Post-War Planning Commis[sion] Chicago 3, Ill.

POSTWAR LABOR POLICY—A SURVEY OF OPINION—Bureau of National Af[fairs] 24th and N. St., Washington, D. C.

HOW A B-G MAINTENANCE PLANT PUTS *QUALITY* INTO SHORT SURFACING JOBS

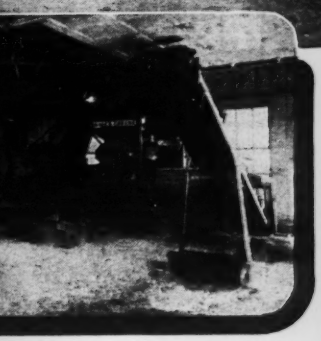
A B-G Portable Maintenance Plant with Dust Collector.

You get the same proportioning, mixing and drying control with this Barber-Greene Maintenance Mixer and Companion Dryer that has made the B-G Heavy Duty Asphalt Plant famous the country over for its accuracy and homogeneity of mix.

With the B-G Maintenance Plant you can economically produce the highest quality bituminous mix for short street and highway jobs, for patching, and for surfacing driveways, parking lots and other small areas.

Dryer and mixer are self-contained mobile units, quickly uncoupled and trailed from one location to another. Speedy, easy erection reduces unproductive hours when changing sites . . . steps up monthly tonnages . . . requires a minimum maintenance crew.

Add up the advantages of the B-G Maintenance Plant with its "continuous flow" capacity of 15 to 30 tons an hour . . . its thoroughly controlled mixing . . . its extreme portability and flexibility, and you'll find where huge savings are effected in time and money over the years in patching, putting down short stretches and handling small blacktop paving jobs. Barber-Greene Company, Aurora, Illinois.



Where a permanent set-up is desired, equipment is furnished without running gear. Mixer can be used as separate unit when desired. Plant produces all types of bituminous material—hot, cold, sand, sheet, powdered and emulsion mixtures

ARMY (E) NAVY

45-12

Barber-Greene B G *Constant Flow Equipment*

SPEED
CONSTRUCTION
WITH
CLIPPER
MASONRY SAWS
Cut the desired shape or size at a moment's notice, from
GLAZED TILE . . .
BRICK . . . . . .
CONCRETE BLOCKS
. . . . or any other Masonry Material, regardless of hardness or density.
Offered to You on
FREE TRIAL
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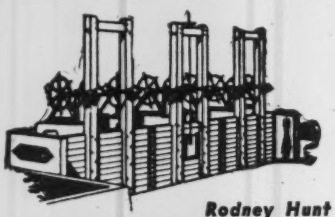

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Men and Jobs

A. Frederick Griffin, chief engineer, Upper Mississippi Valley Division, Corps of Engineers, recently was presented the "Exceptional Civilian Service Award." "This award, the highest distinction granted to its civilian employees, was made by the War Department in recognition of outstanding contribution to the war effort. The emblem and appropriate citation was presented by **Lt. Gen. Eugene Reybold,** Chief of Engineers, U. S. Army."

Fabian S. Miller is now city engineer of Palo Alto, Calif. He succeeds **L. Harold Anderson,** now chairman of the State Railroad Commission.

Lt. Col. Eugene V. Spence, who resigned from the Army to accept his new post, recently took oath as a member of the Texas State Board of Water Engineers.

Charles Hampton has been named city engineer at Osceola, Ark., succeeding **Ed Wiseman** who resigned recently.

The Ontario Dominion Department of Reconstruction has appointed **Beverley K. Boulton** of Quebec City as president of Wartime Housing, Ltd.

John L. Savage, Denver, Colo., has retired as chief designing engineer for the Bureau of Reclamation.

Lt. Col. William R. Harrison, formerly civilian employee of the Vicksburg Engineer District, has been awarded the Distinguished Service Cross for outstanding service in the Pacific.

J. B. Martin, district engineer for the state department of roads and irrigation stationed at Norfolk, Neb., has resigned. He is succeeded by **L. N. Ress,** at present district engineer at Ainsworth. Mr. Ress is succeeded at Ainsworth by **J. M. Cook,** formerly of Neligh.

John A. Nichols has been appointed city engineer at Kent, Ohio.

Col. Alfred L. Marcum, former area engineer at the Savanna, Ill., Ordnance Depot, has recently returned to that post.

Lloyd Knapp has been appointed superintendent of sewers for the city of Milwaukee. Mr. Knapp has been special assistant engineer in the city

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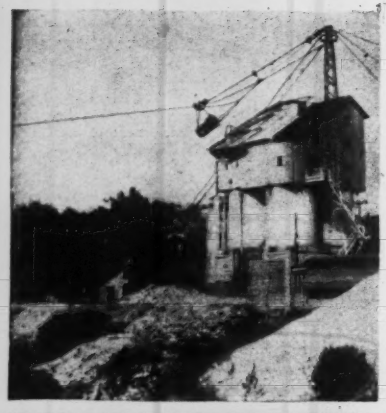

(Upper View) Sauerman Slackline Cableway moving gravel from wet pit to screening plant. (Lower View) Sauerman Scraper reclaiming crushed rock from stockpile.

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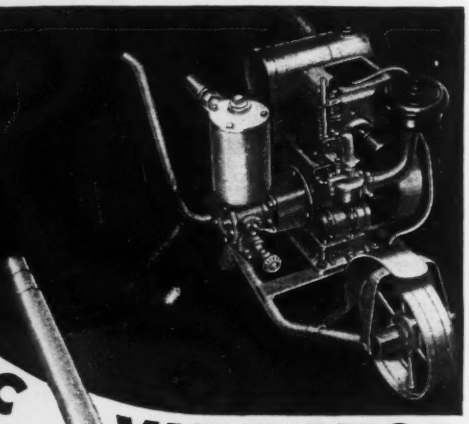

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engineering department, and previously was engineer in charge of grade crossing abolition.

Leon Gottlieb, highway engineer with the Alabama state highway department prior to his entry into the army, has been promoted to lieutenant colonel.

Sam D. Henkle has resigned as Warren County, Ohio, engineer.

H. W. Zimmerman, of Lexington, N. C., has been appointed county manager of Davidson County, succeeding **French H. Smith,** who resigned recently to become city manager at Lexington.

Herbert Wickencamp, county engineer at Audubon, Iowa, has resigned to take a post with the Armco Drainage Corp. in Des Moines. **Raymond Rosenkilde** has been appointed acting engineer for the county.

Thomas O'Dell, former assistant division engineer at Antler, Okla., has been appointed highway department division engineer at Duncan.

George S. Cowdrey, for many years with the Denver office of the Federal Works Administration, has been transferred to San Diego, Calif., where he will serve as supervising engineer.

Warren Veatch, Mt. Vernon, Ohio, has been appointed Knox County, Ohio, engineer, to fill the unexpired term of **Floyd Ellis,** resigned.

Several charges in the engineering personnel of the Ohio state highway department have been announced by **Harry T. Ford,** director. They include **L. F. Schaeublin,** acting chief engineer, Bureau of Maintenance and Repair; **Fred E. Swineford,** chief engineer, Bureau of Construction; **Murray D. Shaffer,** reappointed chief engineer of the Bureau of Location and Design.

Del E. Webb and **L. C. Jacobson** have become partners in the Del E. Webb Construction Co. of Phoenix, Ariz., and Los Angeles, Calif. The firm has done many millions of dollars of construction for the government. Mr. Jacobson had been associated with his father as a contractor in Tucson. He joined Mr. Webb in 1938 as a timekeeper on the State Capitol building construction job. He soon was promoted to estimator and later to chief estimator, and chief engineer.

Lt. Col. Fred L. Ackerson has been reported as Fort Benning, Ga., post engineer, succeeding **Lt. Col. Edward Littleton** who was transferred to Camp McCain, Miss.